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1851

Wood Block Illus

THE HISTORY AND PRACTICE OF THE ART OF PHOTOGRAPHY;

OR THE

PRODUCTION OF PICTURES, THROUGH THE AGENCY OF LIGHT.

CONTAINING

ALL THE INSTRUCTIONS NECESSARY FOR THE COMPLETE PRACTICE OF THE DAGUERREAN AND PHOTOGENIC ART, BOTH ON METALLIC PLATES AND ON PAPER.

BY HENRY H. SNELLING.

THIRD EDITION, CORRECTED AND REVISED.

Illustrated with Wood Cuts.

NEW-YORK:
PUBLISHED BY G. P. PUTNAM,
155 BROADWAY.
1851.

PREFACE TO SECOND EDITION.

The rapid sale of the first edition of the Art of Photography, has made it incumbent upon me to issue a second several months sooner than my most sanguine wishes led me to hope, and it is with no ordinary feelings of gratitude that I return thanks for the liberal patronage bestowed upon my humble effort.

The circumstance gives me pleasure, also, on other grounds than the mere personal gratification every author must feel at the rapid sale of his works. It has convinced those who thought the enterprise a hazardous one—from an erroneous opinion that sufficient intelligence did not exist among the Daguerrean Artists of America, to appreciate the advantages of a text book of the kind presented—that our operators are not all machines, set in motion like a steam-engine, incapable of improvement beyond a certain point. The rapid sale of the first edition proves conclusively, that our artists, not satisfied with the mere mechanical knowledge of the art, are, on the contrary, even desirous of improving both it and themselves.

They are now celebrated throughout the civilized world as the very best Photographists, and it is with a national pride

that I record the fact, that many English, French and German travellers of distinction have visited the galleries of our artists for the purpose of taking home specimens of their skill and excellence, and, to use the words of one of them, "to show the artists of England how far they are behind their trans-atlantic brethren."

While we have such men as Whipple, of Boston, Brady and Lawrence, of New-York, Root, of Philadelphia, Whitehurst, of Baltimore, Davie, of Utica, and a host of others, from Maine to Texas, whose names we should be glad to mention had we the space to spare, sending forth their thousands of exquisitely executed Daguerreotypes yearly, and ever ready to search out and adopt improvements, we have no fear that the meed of excellence now awarded to our American artists will ever be taken from them.

Among the improvements of the day, we would again notice the "Crayon Daguerreotypes," invented by Mr. Whipple, of Boston, who will accept our thanks for his favors.

To Mr. Davie, of Utica, we are also indebted for many improvements in the art; among which, is his plate vice and buffing lathe, described in another part of this work. In our next edition—if we be so fortunate as to issue one—we trust to be able to give to the world such as he does not, at present, consider it prudent to make public. While on the subject, however, we must apologize to Mr. Davie for the error we committed in the matter of the *Plate vice*, (Fig. 11,) described on page 51. This valuable article was the invention of Mr. Davie, and not of the Messrs. Lewis, and in justice to Mr. Davie, I am bound to make this correction. It has been proved conclusively, that seven months previous to the application of Messrs. Lewis for a patent, Mr. Davie manufactured

them at Utica, and sold them to artists in every part of Western New-York; and I distinctly remember having seen it exhibited in this city by Mr. Davie, at least three months previous to Messrs. Lewis's claim to the invention.

The Messrs. Lewis have done much in the improvement of Daguerreotype apparatus, and have the satisfaction of knowing that their articles are almost universally adopted. They deserve our thanks for their enterprise, but in speaking favorably of them, I must not forget what is due to others; neither should they, in their praiseworthy efforts to improve, endeavor to deprive another of his undoubted rights. I have deemed it necessary to say this much in regard to the matter in extenuation of my own error; the Messrs. Lewis well know that it is not partiality on my part, a reference to Chap. V. being proof to the contrary.

It will be perceived that I have made several valuable additions to the "Art of Photography," which I trust will prove acceptable, particularly the chapter on "Position," which I have inserted at the request of several artists.

PREFACE TO THIRD EDITION.

We are again called upon to issue another edition of this work in less than one year from the publication of the last.

We received the following note in regard to our strictures in the second edition, respecting the Patent Plate Vice. We publish it and leave the public to form their own opinion as to the merits of the case. Candor, however, forces us to declare that we see nothing in all this to change *our own* opinion. The Messrs. Lewis undoubtedly consider themselves in the right, and are therefore entitled to be heard, whatever may be our own views. We could devote ten pages in giving our reasons, but we wish the subject to drop here. Both parties are now publicly heard ; they must be satisfied.

Mr. H. H. Snelling :

Sir—Having had our attention called to some erroneous femarks in the second edition of your work on the "Art of Photography," respecting our claims as the original inventors of Plate Vice, for which we hold Letters Patent, we take the liberty to send you the following communication addressed by us to Mr. D. D. T. Davie, the gentleman

named in your remarks in connection with said Vice, with a request that you will give it publicity in your next edition, and thereby do us that justice our claim demands.

New York, Feb. 11*th*, 1850.

Mr. D. D. T. Davie:

Sir—Having lately received information that you have reported in several places in this city, (and we suppose elsewhere.) that we had not obtained a patent for our Plate Vice, we take this method of making you acquainted with the principal facts connected with the above-mentioned Patent, viz: Early in 1846, we made our first Vice, and had it in constant use (in fact we have the same one in our possession still) until July 23d, 1848, when we made application for Letters Patent, which was granted on the 23d day of October, 1849; which facts you could have made yourself acquainted with at any time since, if you had been disposed to call upon us with a request to do so. The above statement we are prepared to corroborate by competent witnesses, under oath, at any and all necessary times and places, to an extent calculated to protect our rights and interests.

Yours respectfully,

W. & W. H. LEWIS,

By John Dunshe.

You will observe that over two years elapsed after having made the first Vice, before we made application for a Patent—that length of time having been suffered to pass in hopes of making additional improvements, which were effected, although we did not feel perfectly satisfied with them; for since our claim has been ratified we have made some very necessary and valuable improvements, which we have the satisfaction to know have met with general approval.

INDEX.

INTRODUCTION.

New York, January 27, 1849.

E. Anthony, Esq.

Dear Sir,—In submiting the accompanying "History and Practice of Photography to your perusal, and for your approbation, I do so with the utmost confidence in your ability as a practical man, long engaged in the science of which it treats, as well as your knowledge of the sciences generally, and your regard for candor. To you, therefore, I leave the decision whether or no I have accomplished my purpose, and produced a work which may not only be of practical benefit to the Daguerrean artist, but of general interest to the reading public, and your decision will influence me in offering it for, or withholding it from, publication.

If it meets your approbation, I would most respectfully ask permission to dedicate it to you, subscribing myself,

With esteem,

Ever truly yours,

Henry H. Snelling.

New York, February 1st, 1849.

Mr. H. H. Snelling.

Dear Sir—Your note of January 27th, requesting permission to dedicate to me your "History and Practice of Photography," I esteem a high compliment, particularly since I have read the manuscript of your work.

Such a treatise has long been needed, and the manner in

which you have handled the subject will make the book as interesting to the reading public as it is valuable to the Daguerrean artist, or the amateur dabbler in Photography. I have read nearly all of the many works upon this art that have emanated from the London and Paris presses, and I think the reader will find in yours the pith of them all, with much practical and useful information that I do not remember to have seen communicated elsewhere.

There is much in it to arouse the reflective and inventive faculties of our Daguerreotypists. They have heretofore stumbled along with very little knowledge of the true theory of their art, and yet the quality of their productions is far in advance of those of the French and English artists, most of whose establishments I have had the pleasure of visiting. I feel therefore, that when a sufficient amount of theoretic knowledge shall have been added to this practical skill on the part of our operators, and when they shall have been made fully acquainted with what has been attained or attempted by others, a still greater advance in the art will be manifested.

A GOOD Daguerreotypist is by no means a mere machine following a certain set of fixed rules. Success in this art requires personal skill and artistic taste to a much greater degree than the unthinking public generally imagine; in fact more than is imagined by nine-tenths of the Daguerreotypists themselves. And we see as a natural result, that while the business numbers its thousands of votaries, but few rise to any degree of eminence It is because they look upon their business as a mere mechanical operation, and having no aim or pride beyond the earning of their daily bread, they calculate what will be a fair per centage on the cost of their plate, case, and chemicals, leaving MIND, which is as much CAPITAL as anything else (where it is exercised,) entirely out of the question.

The art of taking photographs on PAPER, of which your work treats at considerable length, has as yet attracted but

little attention in this country, though destined, as I fully believe, to attain an importance far superior to that to which the Daguerreotype has risen.

The American mind needs a waking up upon the subject, and I think your book will give a powerful impulse in this direction. In Germany a high degree of perfection has been reached, and I hope our countrymen will not be slow to follow.

Your interesting account of the experiments of Mr. Wattles was entirely new to me, and is another among the many evidences that when the age is fully ripe for any great discovery, it is rare that it does not occur to more than a single mind.

Trusting that your work will meet with the encouragement which your trouble in preparing it deserves, and with gratitude for the undeserved compliment paid to me in its dedication,

I remain, very sincerely,

Your friend and well wisher,

E. Anthony.

PHOTOGRAPHY.

CHAP. I.

A BRIEF HISTORY OF THE ART.

As in all cases of great and valuable inventions in science and art the English lay claim to the honor of having first discovered that of Photogenic drawing. But we shall see in the progress of this history, that like many other assumptions of their authors, priority in this is no more due them, then the invention of steamboats, or the cotton gin.

This claim is founded upon the fact that in 1802 Mr. Wedgwood recorded an experiment in the Journal of the Royal Institution of the following nature.

"A piece of paper, or other convenient material, was placed upon a frame and sponged over with a solution of nitrate of silver; it was then placed behind a painting on glass and the light traversing the painting produced a kind of copy upon the prepared paper, those parts in which the rays were least intercepted being of the darkest hues. Here, however, terminated the experiment; for although both Mr. Wedgwood and Sir Humphry Davey experimented carefully, for the purpose of endeavoring

to fix the drawings thus obtained, yet the object could not be accomplished, and the whole ended in failure."

This, by their own showing, was the earliest attempt of the English savans. But this much of the principle was known to the Alchemists at an early date—although practically produced in another way—as the following experiment, to be found in old books, amply proves.

"Dissolve chalk in aquafortis to the consistence of milk, and add to it a strong solution of silver; keep this liquor in a glass bottle well stopped; then cutting out from a piece of paper the letters you would have appear, paste it on the decanter, and lay it in the sun's rays in such a manner that the rays may pass through the spaces cut out of the paper and fall on the surface of the liquor; the part of the glass through which the rays pass will be turned black, while that under the paper remains white; but particular care must be observed that the bottle be not moved during the operation."

Had not the alchemists been so intent upon the desire to discover the far famed philosopher's stone, as to make them unmindful of the accidental dawnings of more valuable discoveries, this little experiment in chemistry might have induced them to prosecute a more thorough search into the principle, and Photogenic art would not now, as it is, be a new one.

It is even asserted that the Jugglers of India were for many ages in possession of a secret by which they were enabled, in a brief space, to copy the likeness of any individual by the action of light. This fact, if fact it be, may account for the celebrated magic mirrors said to be possessed by these jugglers, and probable cause of their power over the people.

However, as early as 1556 the fact was established that a combination of chloride and silver. called, from its appearance, horn silver, was blackened by the sun's rays ; and in the latter part of the last century Mrs. Fulhame published an experiment by which a change of color was effected in the chloride of gold by the agency of light ; and gave it as her opinion that words might be written in this way. These incidents are considered as the first steps towards the discovery of the Photogenic art.

Mr. Wedgwood's experiments can scarcely be said to be any improvement on them since he failed to bring them to practical usefulness, and his countrymen will have to be satisfied with awarding the honor of its complete adaptation to practical purposes, to MM. Niepce and Daguerre of France, and to Professors Draper, and Morse of New-York.

These gentlemen—MM. Niepce and Daguerre—pursued the subject simultaneously, without either, however being aware of the experiments of his colleague in science. For several years, each pursued his researches individually until chance made them acquainted, when they entered into co-partnership, and conjointly brought the art almost to perfection.

M. Niepce presented his first paper on the subject to the Royal Society in 1827, naming his discovery Heliography. What led him to the study of the principles of the art I have no means, at present, of knowing, but it was probably owing to the facts recorded by the Alchemists, Mrs. Fulhame and others, already mentioned. But M. Daguerre, who is a celebrated dioramic painter, being desirous of employing some of the singularly changeable salts of silver to produce a peculiar class of effects in his

paintings, was led to pursue an investigation which resulted in the discovery of the Daguerreotype, or Photogenic drawing on plates of copper coated with silver.

To this gentleman—to his liberality—are we Americans indebted for the free use of his invention; and the large and increasing class of Daguerrean artists of this country should hold him in the most profound respect for it. He was not willing that it should be confined to a few individuals who might monopolise the benefits to be derived from its practice, and shut out all chance of improvement. Like a true, noble hearted French gentleman he desired that his invention should spread freely throughout the whole world. With these views he opened negociations with the French government which were concluded most favorably to both the inventors, and France has the "glory of endowing the whole world of science and art with one of the most surprising discoveries that honor the land."

Notwithstanding this, it has been patented in England and the result is what might have been expected: English pictures are far below the standard of excellence of those taken by American artists. I have seen some medium portraits, for which a guinea each had been paid, and taken too, by a celebrated artist, that our poorest Daguerreotypists would be ashamed to show to a second person, much less suffer to leave their rooms.

Calotype, the name given to one of the methods of Photogenic drawing on paper, discovered, and perfected by Mr. Fox Talbot of England, is precisely in the same predicament, not only in that country but in the United States, Mr. Talbot being patentee in both. He is a man of some wealth, I believe, but he demands so high a price

for a single right in this country, that none can be found who have the temerity to purchase.

The execution of his pictures is also inferior to those taken by the German artists, and I would remark *en passant*, that the Messrs. Mead exhibited at the last fair of the American Institute, (of 1848,) four Calotypes, which one of the firm brought from Germany last Spring, that for beauty, depth of tone and excellence of execution surpass the finest steel engraving.

When Mr. Talbot's patent for the United States expires and our ingenious Yankee boys have the opportunity, I have not the slightest doubt of the Calotype, in their hands, entirely superceding the Daguerreotype.

Let them, therefore, study the principles of the art as laid down in this little work, experiment, practice and perfect themselves in it, and when that time does arrive be prepared to produce that degree of excellence in Calotype they have already obtained in Daguerreotype.

It is to Professor Samuel F. B. Morse, the distinguished inventor of the Magnetic Telegraph, of New York, that we are indebted for the application of Photography, to portrait taking. He was in Paris, for the purpose of presenting to the scientific world his Electro-Magnetic Telegraph, at the time, (1838,) M. Daguerre announced his splendid discovery, and its astounding results having an important bearing on the arts of design arrested his attention. In his letter to me on the subject, the Professor gives the following interesting facts.

"The process was a secret, and negociations were then in progress, for the disclosure of it to the public between the French government and the distinguished discoverer. M. Daguerre had shown his results to the king, and to a few only of the distinguished savans, and by the advice

of M. Arago, had determined to wait the action of the French Chambers, before showing them to any other persons. I was exceedingly desirous of seeing them, but knew not how to approach M. Daguerre who was a stranger to me. On mentioning my desire to Robert Walsh, Esq., our worthy Consul, he said to me; 'state that you are an American, the inventor of the Telegraph, request to see them, and invite him in turn to see the Telegraph, and I know enough of the urbanity and liberal feelings of the French, to insure you an invitation.' I was successfull in my application, and with a young friend, since deceased, the promising son of Edward Delevan, Esq., I passed a most delightful hour with M. Daguerre, and his enchanting sun-pictures. My letter containing an account of this visit, and these pictures, was the first announcement in this country of this splendid discovery."

" I may here add the singular sequel to this visit. On the succeeding day M. Daguerre paid me a visit to see the Telegraph and witness its operations. He seemed much gratified and remained with me perhaps two hours; two melancholy hours to him, as they afterwards proved; for while he was with me, his buildings, including his diorama, his studio, his laboratory, with all the beautiful pictures I had seen the day before, were consumed by fire. Fortunately for mankind, matter only was consumed, the soul and mind of the genius, and the process were still in existence."

On his return home, Professor Morse waited with impatience for the revelation of M. Daguerre's process, and no sooner was it published than he procured a copy of the work containing it, and at once commenced taking Daguerreotype pictures. At first his object was solely

to furnish his studio with studies from nature; but his experiments led him into a belief of the practicability of procuring portraits by the process, and he was undoubtedly the first whose attempts were attended with success Thinking, at that time, that it was necessary to place the sitters in a very strong light, they were all taken with their eyes closed.

Others were experimenting at the same time, among them Mr. Wolcott and Prof. Draper, and Mr. Morse, with his acustomed modesty, thinks that it would be difficult to say to whom is due the credit of the first Daguerreotype portrait. At all events, so far as my knowledge serves me, Professor Morse deserves the laurel wreath, as from him originated the first of our inumerable class of Daguerreotypists; and many of his pupils have carried the manipulation to very great perfection. In connection with this matter I will give the concluding paragraph of a private letter from the Professor to me; He says.

" If mine were the first, other experimenters soon made better results, and if there are any who dispute that I was first, I shall have no argument with them; for I was not so anxious to be the *first* to produce the result, as to produce it in any way. I esteem it but the natural carrying out of the wonderful discovery, and that the credit was after all due to Daguerre. I lay no claim to any improvements."

Since I commenced the compilation of this work, I have had the pleasure of making the acquaintance of an American gentleman—James M. Wattles Esq.—who as early as1828—and it will be seen, by what I have already stated, that this is about the same date of M. Niepce's

discovery—had his attention attracted to the subject of Photography, or as he termed it "Solar picture drawing," while taking landscape views by means of the camera-obscura. When we reflect upon all the circumstances connected with his experiments. the great disadvantages under which he labored, and his extreme youthfullness, we cannot but feel a national pride—yet wonder—that a mere yankee boy, surrounded by the deepest forests, hundred of miles from the populous portion of our country, without the necessary materials, or resources for procuring them, should by the force of his natural genius make a discovery, and put it in practical use, to accomplish which, the most learned philosophers of Europe, with every requisite apparatus, and a profound knowledge of chemistry—spent years of toil to accomplish. How much more latent talent may now be slumbering from the very same cause which kept Mr. Wattles from publicly revealing his discoveries, viz ; want of encouragement—ridicule !

At the time when the idea of taking pictures permanently on paper by means of the camera-obscura first occurred to him, he was but sixteen years of age, and under the instructions of Mr. Charles Le Seuer, (a talented artist from Paris) at the New Harmony school, Indiana Drawing and painting being the natural bent of his mind, he was frequently employed by the professors to make landscape sketches in the manner mentioned. The beauty of the image of these landscapes produced on the paper in the camera-obscura, caused him to pause and admire them with all the ardor of a young artist, and wish that by some means, he could fix them there in all their beauty. From wishing he brought himself to think that it was not only possible but actually capable of accomplish-

ment, and from thinking it could, he resolved it should be done.

He was, however, wholly ignorant of even the first principles of chemistry, and natural philosophy, and all the knowledge he was enabled to obtain from his teachers was of very little service to him. To add to this, whenever he mentioned his hopes to his parents, they laughed at him, and bade him attend to his studies and let such moonshine thoughts alone—still he persevered, though secretly, and he met with the succes his peseverance deserved.

For the truth of his statement, Mr. Wattles refers to some of our most respectable citizens residing at the west, and I am in hopes that I shall be enabled to receive in time for this publication, a confirmation from one or more of these gentlemen. Be that as it may, I feel confident in the integrity of Mr. Wattles, and can give his statement to the world without a doubt of its truth.

The following sketch of his experiments and their results will, undoubtedly, be interesting to every American reader and although some of the profound philosophers of Europe may smile at his method of proceeding, it will in some measure show the innate genius of American minds, and prove that we are not far behind our trans-atlantic brethren in the arts and sciences.

Mr. Wattles says: "In my first efforts to effect the desired object, they were feeble indeed, and owing to my limited knowledge of chemistry—wholly acquired by questioning my teachers—I met with repeated failures; but following them up with a determined spirit, I at last produced, what I thought very fair samples—but to proceed to my experiments."

"I first dipped a quarter sheet of thin white writing

paper in a weak solution of caustic (as I then called it) and dried it in an empty box, to keep it in the dark; when dry, I placed it in the camera and watched it with great patience for nearly half an hour, without producing any visible result; evidently from the solution being to weak. I then soaked the same piece of paper in a solution of common potash, and then again in caustic water a little stronger than the first, and when dry placed it in the camera. In about forty-five minutes I plainly percieved the effect, in the gradual darkening of various parts of the view, which was the old stone fort in the rear of the school garden, with the trees, fence, &c. I then became convinced of the practicability of producing beautiful solar pictures in this way; but, alas! my picture vanished and with it, all—no not *all*—my hopes. With renewed determination I began again by studying the nature of the preparation, and came to the conclusion, that if I could destroy the part not acted upon by the light without injuring that which was so acted upon, I could save my pictures. I then made a strong solution of sal. soda I had in the house, and soaked my paper in it, and then washed it off in hot water, which perfectly fixed the view upon the paper. This paper was very poor with thick spots, more absorbent than other parts, and consequently made dark shades in the picture where they should not have been; but it was enough to convince me that I had succeeded, and that at some future time, when I had the means and a more extensive knowledge of chemistry, I could apply myself to it again. I have done so since, at various times, with perfect success; but in every instance laboring under adverse circumstances."

I have very recently learned, that, under the present patent laws of the United States, every foreign patentee

is required to put his invention, or discovery, into practical use within eighteen months after taking out his papers, or otherwise forfeit his patent. With regard to Mr. Talbot's Calotype patent, this time has nearly, if not quite expired, and my countrymen are now at perfect liberty to appropriate the art if they feel disposed. From the statement of Mr. Wattles, it will be perceived that this can be done without dishonor, as in the first instance Mr. Talbot had no positive right to his patent.

Photography; or sun-painting is divided, according to the methods adopted for producing pictures, into

DAGUERREOTYPE,	CHROMATYPE,
CALOTYPE,	ENERGIATYPE,
CHRYSOTYPE,	ANTHOTYPE and
CYANOTYPE,	AMPHITYPE.

CHAP. II.

THE THEORY ON LIGHT.—THE PHOTOGRAPHIC PRINCIPLE

Some philosophers contend that to the existence of light alone we owe the beautiful effects produced by the Photogenic art, while others give sufficient reasons for doubting the correctness of the assumption. That the results are effected by a principle associated with light and not by the luminous principle itself, is the most probable conclusion. The importance of a knowledge of this fact becomes most essential in practice, as will presently be seen. To this principle Mr. Hunt gives the name of Energia.

The Nature of Light is not wholly known, but it is generally believed to be matter, as in its motions it obeys the laws regulating matter. So closely is it connected with heat and electricity that there can be little doubt of their all being but different modifications of the same substance. I will not, however, enter into a statement of the various theories of Philosophers on this head, but content myself with that of Sir Isaac Newton; who supposed rays of light to consist of minute particles of matter, which are constantly emanating from luminous bodies and cause vision, as odoriferous particles, proceeding from certain bodies, cause smelling.

The *effects* of light upon *other bodies*, and how light is effected by *them*, involve some of the most important principles, which if properly understood by Daguerreotypists would enable them to improve and correct many of the practical operations in their art. These effects we shall exhibit in this and the following chapters. Before we enter on this subject it will be necessary to become familiar with the

Definitions of some of the terms used in the science of optics.

Luminous bodies are of two kinds; those which shine by their *own* light, and those which shine by *reflected* light.

Transparent bodies are such as permit rays of light to pass through them.

Translucent bodies permit light to pass faintly, but without representing the figure of an object seen through them.

Opaque bodies permit no light to pass through them, but reflect light.

A *ray* is a line of light.

A *beam* is a collection of parallel rays.

A *pencil* is a collection of converging, or diverging rays.

A *medium* is any space through which light passes.

Incident rays are those which fall upon the surface of a body.

Reflected rays are those which are thrown off from a body.

Parallel rays are such as proceed equally distant from each other through their whole course.

Converging rays are such as approach and tend to unite at any one point, as at *b* *fig.* 3.

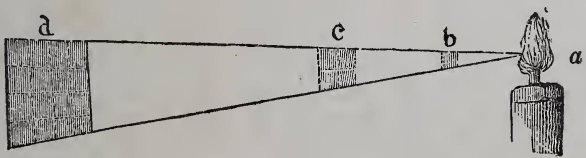
Diverging rays are those which continue to recede from each other, as at *c*. *Fig*. 3.

A *Focus* is that point at which converging rays meet.

MOTION OF LIGHT—Rays of light are thrown off from luminous bodies in every direction, but always in straight lines, which cross each other at every point; but the particles of which each ray consists are so minute that the rays do not appear to be impeded by each other. A ray of light passing through an aperture into a dark room, proceeds in a straight line; a fact of which any one may be convinced by going into a darkened room and admiting light only through a small aperture.

Light also moves with great velocity, but becomes fainter as it recedes from the source from which it eminates; in other words, diverging rays of light diminish in intensity as the square of the distance increases. For instance; let *a* fig. 1, represent the luminous body from

FIG. 1.



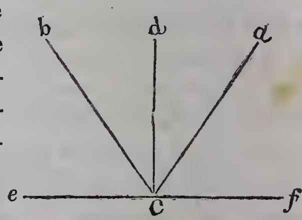
which light proceeds, and suppose three square boards, *b*. *c*. *d*. severally one, four and sixteen square inches in size be placed; *b* one foot, *c* two feet, and *d* four feet from *a*, it will be perceived that the smallest board *b* will throw *c* into shadow; that is, obstruct all rays of light that would otherwise fall on *c*, and if *b* were removed *c* would in like manner hide the light from *d*—Now, if *b* recieve as much light as would fall on *c* whose surface is four times as large, the light must be four times as pow-

erful, and sixteen times as powerful as that which would fall on the second and third boards, because the same quantity of light is diffused over a space four and sixteen times greater. These same rays may be collected and their intensity again increased.

Rays of light are *reflected* from one surface to another; *Refracted*, or bent, as they pass from the surface of one transparent medium to another; and *Inflected*, or turned from their course, by the attraction of opaque bodies. From the first we derive the principles on which mirrors are constructed; to the second we are indebted for the power of the *lenses*, and the blessings of sight,—for the light acts upon the *retina* of the eye in the same manner as on the lens of a camera. The latter has no important bearing upon our subject.

When a ray of light falls perpendicularly upon an opaque body, it is reflected back in the same line in which it proceeds; in this case the *reflected* ray returns in the same path the *incident* ray traversed; but when a ray falls obliquely, it is reflected obliquely, that is, it is thrown off in an opposite direction, and as far from the perpendicular as was the incident ray, as shown at *Fig.* 2; *a* representing the incident ray and *b* the reflected. The point, or angle *c* made by the incident ray, at the surface of the reflector *e f*, with a line *c d*, perpendicular to that surface, is called the *angle of incidence*, while the angle formed by the reflected ray *b* and the perpendicular line *d* is called the *angle of reflection*, and these angles are always equal.

FIG. 2.



It is by this reflection of light that objects are made visible; but unless light falls directly upon the eye they are invisible, and are not sensibly felt until after a certain series of operations upon the various coverings and humors of the eye. Smooth and polished surfaces reflect light most powerfully, and send to the eye the images of the objects from which the light proceeded before reflection. Glass, which is transparent—*transmitting light*—would be of no use to us as a mirror, were it not first coated on one side with a metalic amalgam, which interrupts the rays in their passage from the glass into the air, and throws them either directly in the incident line, or in an oblique direction. The reason why trees, rocks and animals are not all mirrors, reflecting other forms instead of their own, is, that their surfaces are uneven, and rays of light reflected from an uneven surface are diffused in all directions.

Parallel rays falling obliquely upon a plane mirror are reflected parallel; converging rays, with the same degree of convergence; and diverging rays equally divergent.

Stand before a mirror and your image is formed therein, and appears to be as far behind the glass as you are before it, making the angle of reflection equal to that of incidence, as before stated. The incident ray and the reflected ray form, together, what is called the passage of reflection, and this will therefore make the actual distance of an image to appear as far again from the eye as it really is. Any object which reflects light is called a radiant. The point behind a reflecting surface, from which they appear to diverge, is called the virtual focus.

Rays of light being reflected at the same angle at which they fall upon a mirror, two persons can stand in such a position that each can see the image of the other without seeing his own. Again; you may see your

whole figure in a mirror half your length, but if you stand before one a few inches shorter the whole cannot be reflected, as the incident ray which passes from your feet into the mirror in the former case, will in the latter fall under it. Images are always reversed in mirrors.

Convex mirrors reflect light from a rounded surface and disperse the rays in every direction, causing parallel rays to diverge, diverging rays to diverge more, and converging rays to converge less—They represent objects smaller than they really are—because the angle formed by the reflected ray is rendered more acute by a convex than by a plane surface, and it is the diminishing of the visual angle, by causing rays of light to be farther extended before they meet in a point, which produces the image of convex mirrors. The greater the convexity of a mirror, the more will the images of the objects be diminished, and the nearer will they appear to the surface. These mirrors furnish science with many curious and pleasing facts.

Concave mirrors are the reverse of convex; the latter being rounded outwards, the former hollowed inwards—they render rays of light more converging—collect rays instead of dispersing them, and magnify objects while the convex diminishes them.

Rays of light may be collected in the focus of a mirror to such intensity as to melt metals. The ordinary burning glass is an illustration of this fact; although the rays of light are refracted, or passed through the glass and concentrated into a focus beneath.

When incident rays are parallel, the reflected rays converge to a focus, but when the incident rays proceed from a focus, or are divergent, they are reflected parallel. It is only when an object is nearer to a concave mirror than its

centre of concavity, that its image is magnified; for when the object is farther from the mirror, this centre will appear less than the object, and in an inverted position.

The centre of concavity in a concave mirror, is an imaginary point placed in the centre of a circle formed by continuing the boundary of the concavity of the mirror from any one point of the edge to another parallel to and beneath it.

REFRACTION OF LIGHT:—I now pass to the consideration of the passage of light through bodies.

A ray of light falling perpendicularly through the air upon a surface of glass or water passes on in a straight line through the body; but if it, in passing from one medium to another of different density, fall obliquely, it is bent from its direct course and recedes from it, either towards the right or left, and this bending is called refraction; (*see fig.* 3, *b.*) If a ray of light passes from a rarer into a denser medium it is refracted towards a perpendicular in that medium; but if it passes from a denser into rarer it is bent further from a perpendicular in that medium. Owing to this bending of the rays of light the angles of refraction and incidence are never equal.

Transparent bodies differ in their power of bending light—as a general rule, the refractive power is proportioned to the density—but the chemical constitution of bodies as well as their density, is found to effect their refracting power. Inflamable bodies possess this power to a great degree.

The sines of the angle of incidence and refraction (that is, the perpendicular drawn from the extremity of an arc to the diameter of a circle,) are always in the same ratio; viz: from air into water, the sine of the angle of refraction is nearly as four to three, whatever be the position of

the ray with respect to the refracting surface. From air into sulphur, the sine of the angle of refraction is as two to one—therefore the rays of light cannot be refracted whenever the sine of the angle of refraction becomes equal to the radius * of a circle, and light falling very obliquely upon a transparent medium ceases to be refracted; this is termed *total reflection.*

Since the brightness of a reflected image depends upon the quantity of light, it is quite evident that those images which arise from total reflection are by far the most vivid, as in ordinary cases of reflection a portion of light is absorbed.

I should be pleased to enter more fully into this branch of the science of optics, but the bounds to which I am necessarily limited in a work of this kind will not admit of it. In the next chapter, however, I shall give a synopsis of Mr. Hunt's treatise on the "Influence of the Solar Rays on Compound Bodies, with especial reference to their Photographic application"—A work which should be in the hands of every Daguerreotypist, and which I hope soon to see republished in this country. I will conclude this chapter with a brief statement of the principles upon which the Photographic art is founded.

SOLAR and Steller light contains three kinds of rays, viz:

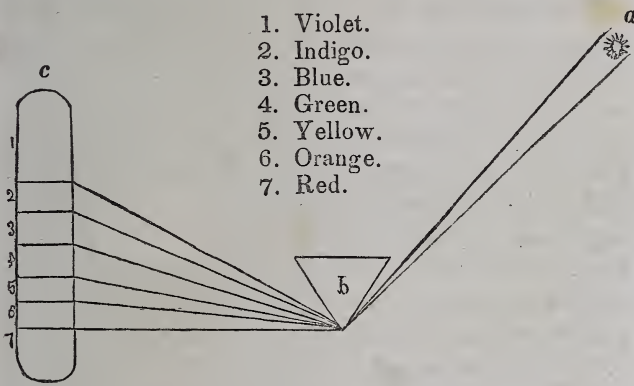
1. *Colorific*, or rays of color.
2. Calorific, or rays of heat.
3. Chemical rays, or those which produce chemical effects.

On the first and third the photographic principle depends. In explaining this principle the accompanying wood cuts, (*figs.* 3 and 4) will render it more intelligible.

* The RADIUS of a circle is a straight line passing from the centre to the circumference.

If a pencil of the sun's rays fall upon a prism, it is bent in passing through the transparent medium ; and some rays being more refracted than others, we procure an elongated image of the luminous beam, exhibiting three distinct colors, red, yellow and blue, which are to be regarded as primitives—and from their interblending, seven, as recorded by Newton, and shown in the accompanying wood cut. These rays being absorbed, or reflected differently by various bodies, give to nature the charm of color. Thus to the eye is given the pleasure we derive in looking upon the green fields and forests, the enumerable varieties of flowers, the glowing ruby, jasper, topaz, amethist, and emerald, the brilliant diamond, and all the rich and varied hues of nature, both animate and inanimate.

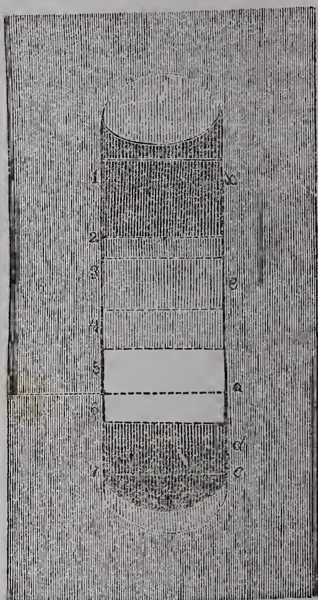
Fig. 3.



Now, if we allow this prismatic spectrum (*b. fig.* 3.) to fall upon any surface (as at *c.*) prepared with a sensitive photographic compound, we shall find that the *chemical* effect produced bears no relation to the intensity of the *light* of any particular colored ray, but that, on the

contrary, it is dispersed over the largest portion of the spectrum, being most energetic in the least luminous rays, and ever active over an extensive space, where no traces of light can be detected. *Fig.* 4, will give the student a better idea of this principle. It is a copy of the kind of impression which the spectrum, spoken of, would make on a piece of paper covered with a very sensitive photographic preparation. The *white* space *a.* corresponds with the most luminous, or yellow ray, (5, fig. 3) over the limits of which all chemical change is prevented. A similar action is also produced by the lower end of the red ray *c*; but in the upper portion, however we find a decided change (as at *d*). The most active chemical change, you will percieve, is produced by the rays above the yellow *a*; viz. 4, 3, 2 and 1 (as at *b*) the green (4) being the least active, and the blue (3) and violet (1) rays the most so, the action still continuing far beyond the point *b* which is the end of the luminous image.

FIG. 4.



Suppose we wish to copy by the Daguerreotype, or Calotype process, any objects highly colored—blue, red and yellow, for instance predominating—the last of course reflects the most light, the blue the least; but the rays

from the blue surface will make the most intense impression, whilst the red radiations are working very slowly, and the yellow remains entirely inactive. This accounts for the difficulty experienced in copying bright green foliage, or warmly colored portraits; a large portion of the yellow and red rays entering into the composition of both—and the imperfections in a Daguerreotype portrait of a person with a freckled face depends upon the same cause —(*See note to 2d Ed., p.* 28.)

A yellow, hazy atmosphere, even when the light is very bright, will effectually prevent any *good* photographic result—and in the height of summer, with the most sensative process, it not unfrequently happens that the most annoying failures arise from this agency of a yellow medium. A building painted of a yellow color, which may reflect the sun's rays directly into the operator's room will have the same effect. Daguerreotypists, being ignorant of these facts, are very apt to charge their want of success to the plates, or chemicals, or any thing but the real cause; and it would be well to bear these facts constantly in mind and as far as possible avoid them. This, may be accomplished, in a measure, by a choice of location or by having the glass of your windows tinged with blue ; or a screen of thin blue paper may be interposed between the light and sitter. In selecting subjects, all striking contrasts in color should be avoided, and sitters for portraits should be cautioned not to wear anything that may produce the effect spoken of—dark dresses always being the best.

The action of light both combines and decomposes bodies. For instance, chlorine and hydrogen will remain in a glass vessel without alteration if kept in the dark; but if exposed to the rays of the sun, they imme-

diately enter into combination, and produce hydrochloric acid. On the other hand, if colorless nitric acid be exposed to the sun, it becomes yellow, then changes to red, and oxygen is liberated by the partial decomposition effected by the solar rays.

Of the organic substances none are more readily acted upon by light than the various combinations of silver.

Of these some are more, and others less sensitive. If Chloride of silver, which is a white precipitate formed by adding chloride of sodium (common salt) to a solution of nitrate of silver, be exposed to diffused light, it speedily assumes a violet tint, and ultimately becomes nearly black. With iodide of silver, bromide of silver, ammonio-nitrate of silver, and other salts of this metal, the result will be much the same.

Some bodies, which under the influence of light, undergo chemical changes, have the power of restoring themselves to their original condition in the dark. This is more remarkably displayed in the iodide of platinum, which readily recieves a photogenic image by darkening over the exposed surfaces, but speedily loses it by bleaching in the dark. The ioduret of Daguerre's plate, and some other iodides, exhibit the same peculiarity—This leads us to the striking fact, that bodies which have undergone a change of estate under the influence of daylight have some latent power by which they can renovate themselves. Possibly the hours of night are as necessary to inanimate nature as they are to the animate. During the day, an excitement which we do not heed, unless in a state of disease, is maintained by the influence of light; and the hours of repose, during which the equilibrium is restored, are absolutely necessary to the continuance of health.

Instead of a few chemical compounds of gold and silver, wnich at first were alone supposed to be photographic, we are now aware that copper, platinum, lead, nikel, and indeed, probably all the elements, are equally liably to change under the sun's influence. This fact may be of benefit to engravers, for if steel can be made to take photographic impressions, the more laborious process of etching may be dispensed with. In fact, in the latter part of this work, a process is described for etching and taking printed impressions from Daguerreotype plates. As yet this process has produced no decided beneficial results—but future experiments may accomplish some practical discovery of intrinsic value to the art of engraving.

A very simple experiment will prove how essential light is to the coloring of the various species comprising the vegetable and animal kingdoms. If we transplant any shrub from the light of day into a dark cellar, we will soon see it lose its bright green color, and become perfectly white.

Another effect of light is that it appears to impart to bodies some power by which they more readily enter into chemical combination with others. We have already said that chlorine and hydrogen, if kept in the dark, will remain unaltered; but if the chlorine alone be previously exposed to the sun, the chlorine thus solarised will unite with the hydrogen in the dark. Sulphate of iron will throw down gold or silver from their solutions slowly in the dark; but if either solution be first exposed to sunshine, and the mixture be then made, in the dark, the precipitation takes place instantly. Here is again, evidence of either an absorption of some material agent from the sunbeam, or an alteration in the chemical constitution of the body. It was from understanding these principles and

applying them that philosophers were enabled to produce the Calotype, Daguerreotype, &c. For the effects and action of light on the camera, see Chapter V.

Some advances have been made towards producing Photographic impressions in color—the impossibility of which, some of our best and oldest artists have most pertinaciously maintained. The colored image of the spectrum has been most faithfully copied, ray for ray, on paper spread with the juice of the *Cochorus Japonica*, (a species of plant) and the fluoride of silver; and on silver plate covered with a thin film of chloride. The day may be still remote when this much to be desired decideratum in portrait taking will be accomplished; but I am led to hope that future experiments may master the secret which now causes it to be looked upon, by many, as an impossibility.

That great advantages have resulted, and that greater still will result from the discovery of the Photographic art, few will deny. The faithful manner in which it copies nature, even to the most minute details, renders it of much value to the painter; but a few minutes sufficing to take a view that formerly would have occupied several days Its superiority in portraits, over miniature or oil painting has been tacitly acknowledged by the thousands who employ it to secure their own, or a friends likeness, and by the steady increase in the number of artists who are weekly, aye daily, springing up in every town and village in the land.

The following extract from a very interesting article in the North British Review, gives facts that every Daguerreotypist should remember:

In the valuable work of Professor Draper, of New-York, there are many important observations, relative to the theory and practice of photography. The belief that he was the first person who discovered, what he calls, "*the antagonizing action of the two halves of the spectrum*," the *blue*, or *more* refrangible half, having a *decomposing* agency on iodide of silver, and the *red*, or less refrangible half, a *protecting* agency. He states that "there is a certain condition of the sky, namely, when it has such a degree of brightness that the sensitive surface is slightly stained by it, under the decomposing effect of its light, is exactly balanced by the protecting agency of the other rays—so exactly balanced, that it is immaterial whether the exposure be for one minute or an hour, for the resulting action is the same." An equilibrium in these two opposite actions, to a greater or less extent, seems to take place even with the solar rays in tropical regions, as if the sun's light there was intrinsically different from what it is here.

In opposition, however, to the idea of such an antagonizing action, Dr. Draper, himself, afterwards affirms, "that the red, orange, and yellow rays which protect the plate from the ordinary photogenic action, were themselves capable, when insulated, of *producing a peculiar photogenic effect*;" while Mr. E. Becquerel maintains, as we have seen, "that they have the property of *continuing* the action of the ordinary photogenic rays, when once commenced." In this state of the subject, M. Claudet began a series of experiments which led to valuable results, and of which he has enabled us to give the following abstract:

"Having directed a camera, with an iodized plate, to the sun when his disc was quite *red*, he left it there for

twenty minutes. The sun had passed over a great space on the plate, which was marked with a long and perfectly defined image of his disc, so that not only had the red sun produced no photogenic action, but the red rays had *destroyed the effect* produced by the previous action of the sky. By moving the camera from right to left, and from left to right, and lowering it each time by means of a screw, he made the sun pass rapidly over *five* or *six* zones of the iodized plate. The lines of his passage were marked with long *black* bands, while the intervals between them were *white*, proving again that the red rays had destroyed the previous photogenic action." M. Claudet obtained the same result with *red*, *orange* and *yellow* glasses. The impression of black lace taken by white light, was destroyed by the rays passing through a red glass, and the same effect was produced in different periods of time by orange and yellow glasses. But what was very remarkable, M. Claudet discovered, that after the photogenic effect was destroyed, *the plate was restored to its former sensitiveness to white light;* nay, we may expose the plate to these two actions alternately, for any number of times, and yet it will be sensitive to the vapor of mercury, if its last exposure has been the white light, and will be deprived of that sensitiveness if its exposure has been to the destroying action of the *red*, *orange*, or *yellow* rays. Hence, M. Claudet arrives at the important practical result, that the Daguerreotype plates may be iodized in open daylight; and that, in order to restore their sensitiveness, which that light has destroyed, we have only to place them for a few minutes under a red glass, before we place them in a camera. M. Claudet has shown, that the discovery by Dr. Draper, of a photogenic action in the red half of the spectrum is true also for the

rays which pass through *red, orange,* and *yellow* glasses, thus proving that these rays have two contrary actions, one destructive of the effects of the photogenic rays, and another analogous to the effect of these rays.

The *photogenic* action of the *red* ray is, according to M. Claudet, 5,000 times slower or weaker than that of *white* light; that of the *orange* rays, 500 times; and that of the *yellow,* 100 times.

The *destructive* action of the *red* rays is 100 times slower or weaker than that of *white* light; the orange 50 times, and the yellow only 10 times.

When a plate has been exposed to the destructive action of any particular ray, it cannot be affected photogenically by the same ray which acted destructively, and it is sensitive only to the other rays; and the photogenic or destructive action of any ray cannot be continued by another. Hence, M. Claudet draws the important conclusion, *that the solar spectrum is endowed with three different photogenic actions, and three different* destroying actions, corresponding to the *red, yellow, and blue rays.* The rays of each of these colours is endowed with a photogenic power peculiar to itself, which causes the mercurial vapor to adhere to the iodized plate, and yet these three actions are so different that we cannot, by combining them artificially, make one assist the other, on account of their antagonistic character. The effect of the *blue* rays is destroyed by the *red* and *yellow,* each of which is in its turn destroyed by the *blue,* while the *yellow* and *red* mutually destroy each other. Hence, it would appear that the iodide of potash remains always the same under these different influences, and that there is no separation or disengagement of its constituent elements.

CHAP. III.

SYNOPSIS OF MR. HUNT'S TREATISE ON "THE INFLUENCE OF THE SOLAR RAYS ON COMPOUND BODIES, WITH ESPECIAL REFERENCE TO THEIR PHOTOGRAPHIC APPLICATION."

Oxide of silver exposed for a few hours to good sunshine, passes into a more decided olive color, than characterises it when first prepared by precipitation from nitrate of silver. Longer exposure renders this color very much lighter, and the covered parts, are found much darker, than those on which the light has acted directly. In some instances where the oxide of silver has been spread on the paper a decided whitening process in some parts, after a few days exposure, is noticed. Oxide of silver disolved in ammonia is a valuable photographic fluid; one application of a strong solution forming an exceedingly sensitive surface. The pictures on this paper are easily fixed by salt or weak ammonia.

Nitrate of silver.—This salt in a state of purity, does not appear to be sensibly affected by light, but the presence of the smallest portion of organic matter renders it exceedingly liable to change under luminous influence.

If a piece of nitrated paper is placed upon hot iron, or held near the fire, it will be found that at a heat just below that at which the paper chars, the salt is decomposed. Where the heat is greatest, the silver is revived,

and immediately around it, the paper becomes a deep blue; beyond this a pretty decided green color results, and beyond the green, a yellow or yellow brown stain is made. This exhibits a remarkable analogy between heat and light,—before spoken of in chap. II—and is of some practical importance in the preparation of the paper.

Prismatic analysis.—The method of accomplishing the prismatic decomposition of rays of light by the spectrum has already been described on pages 22 and 23. The color of the impressed spectrum, on paper washed with nitrate of silver, is at first, a pale brown, which passes slowly into a deeper shade; that portion corresponding with the blue rays becoming a blue brown; and under the violet of a peculiar pinkey shade, a very decided green tint, on the point which corresponds with the least refrangible blue rays, may be observed, its limits of action being near the centre of the yellow ray, and its maximum about the centre of the blue, although the action up to the edge of the violet ray is continued with very little diminution of effect; beyond this point the action is very feeble.

When the spectrum is made to act on paper which has been previously darkened, by exposure to sunshine under cupro-sulphate of ammonia, the phenomena are materially different. The photographic spectrum is lengthened out on the red or negative side by a faint but very visible red portion, which extends fully up to the end of the red rays, as seen by the naked eye. The tint of the general spectrum, too, instead of brown is dark grey, passing, however, at its most refracted or positive end into a ruddy brown.

In its Photographic application, the nitrate of silver is

the most valuable of the salts of that metal, as from it most of the other argentine compounds can be prepared, although it is not of itself sufficiently sensible to light to render it of much use.

Chloride of Silver.—This salt of silver, whether in its precipitated state, or when fused, changes its color to a fine bluish grey by a very short exposure to the sun's rays. If combined with a small quantity of nitrate, the change is more rapid, it attains a deep brown, then slowly passes into a fine olive, and eventually, after a few weeks, the metalic silver is seen to be revived on the surface of the salt. Great differences of color are produced on chlorides of silver precipitated by different muriates. Nearly every variety in combination with the nitrate, becomes *at last* of the same olive color, the following examples, therefore, have reference to a few minutes exposure, only, to good sunshine; it must also be recollected that the chloride of silver in these cases is contaminated with the precipitant.

Muriate of ammonia precipitates chloride to darken to a fine chocolate brown, whilst muriate of lime produces a brick-red color. Muriates of potash and soda afford a precipitate, which darkens speedly to a pure dark brown, and muriatic acid, or aqueous chlorine, do not appear to increase the darkening power beyond the lilac to which the pure chloride of silver changes by exposure. This difference of color appears to be owing to the admixture of the earth or alkali used with the silver salt.

The prismatic impression on paper spread with the chloride of silver is often very beautifully tinted, the intensity of color varying with the kind of muriate used. Spread paper with muriate of ammonia or baryta and you obtain a range of colors nearly corresponding with the

natural hues of the prismatic spectrum. Under favorable circumstances the mean red ray, leaves a red impression, which passes into a green over the space occupied by the yellow rays. Above this a leaden hue is observed, and about the mean blue ray, where the action is greatest, it rapidly passes through brown into black, and through the most refrangible rays it gradually declines into a bluish brown, which tint is continued throughout the invisible rays. At the least refrangible end of the spectrum, the very remarkable phenomenon has been observed, of the extreme red rays exerting a protecting influence, and preserving the paper from that change, which it would otherwise undergo, under the influence of the dispersed light which always surrounds the spectrum. Not only the extreme red ray exerts this very peculiar property, but the ordinary red ray through nearly its whole length.

In photographic drawing this salt is of the utmost importance. Mr. Talbot's application of it will be given hereafter in another portion of this work.

Iodide of silver—Perfectly pure, undergoes very little change under the influence of light or heat; but if a very slight excess of the nitrate of silver be added it becomes infinitely more senitive than the chloride

The spectrum impressed upon paper prepared with a weak solution of the hydriodate of potash presents some very remarkable peculiarities. The maximum of intensity is found at the edge of the most refrangible violet rays, or a little beyond it, varying slightly according to the kind of paper used, and the quantity of free nitrate of silver present. The action commences at a point nearly coincident with the mean red of the luminous spectrum, where it gives a dull ash or lead color, while the most refrangible rays impress a ruddy snuff-brown,

the change of tint coming on rather suddenly abou' the end of the blue or beginning of the violet rays of the luminous spectrum. Beyond the extreme violet rays, the action rapidly diminishes, but the darkening produced by these invisible rays, extends a very small space beyond the point at which they cease to act on the chloride of silver.

In its photographic application, it is, alone, of very little use; but in combination with other re-agents it becomes exquisitely sensitive. With gallic acid and the ferrocyanate of potash it forms two of the most sensitive photographic solutions with which we are acquainted. These are used in the calotype process.

Ioduret of silver.—If upon a plate of polished silver we place a small piece of iodine, and apply the heat of a lamp beneath the plate for a moment, a system of rings is speedily formed. The first ring, which spreading constantly forms the exterior of the circle, is of a bright yellow color; within this, there arises, sucessively, rings of green, red and blue colors, and then again a fine yellow circle, centred by a greyish spot on the place occupied by the iodine. On exposing these to the light, the outer yellow circle almost instantly changes color, the others slowly, in the order of their position, the interior yellow circle resisting for a long time the solar influence. These rings must be regarded as films of the ioduret of silver, varying, not only in thickness, but in the more or less perfect states of combination in which the iodine and metal are. The exterior circle is an ioduret in a very loose state of chemical agregation; the attractive forces increase as we proceed towards the centre, where a well formed ioduret, or probably a true iodide of silver, is formed, which is acted upon by sunlight with difficulty. The exterior and most

sensitive film constitutes the surface of Daguerreotype plates. The changes which these colored rings undergo are remarkable; by a few minutes exposure to sunlight, an inversion of nearly all the colors takes place, the two first rings becoming a deep olive green; and a deep blue inclining to black.

The nature of the change which the ioduret of silver undergoes on Daguerreotype plates, through the action of light, Mr. Hunt considers to be a decided case of decomposition, and cites several circumstances in proof of his position. These with other facts given by Mr. Hunt in his great work on the Photographic art, but to voluminous to include in a volume of the size to which I am obliged to cofine myself, should be thoroughly studied by all Daguerreotypists.

Prismatic analysis.—The most refrangible portion of the spectrum, (on a Daguerreotype plate) appears, after the plate has been exposed to the vapor of mercury, to have impressed its colors; the light and delicate film of mercury, which covers that portion, assuming a fine blue tint about the central parts, which are gradually shaded off into a pale grey; and this is again surrounded by a very delicate rose hue, which is lost in a band of pure white. Beyond this a protecting influence is powerfully exerted; and notwithstanding the action of the dispersed light, which is very evident over the plate, a line is left, perfectly free from mercurial vapor, and which, consequently, when viewed by a side light, appears quite dark. The green rays are represented by a line of a corresponding tint, considerably less in size than the luminous green rays. The yellow rays appear to be without action, or to act negatively, the space upon which they fall being protected from the mercurial vapor; and it

consequently is seen as a dark band. A white line of vapor marks the place of the orange rays. The red rays effect the sensitive surface in a peculiar manner; and we have the mercurial vapor, assuming a molecular arrangement which gives to it a fine rose hue; this tint is surrounded by a line of white vapor, shaded at the lowest extremity with a very soft green. Over the space occupied by the extreme red rays, a protecting influence is again exerted; the space is retained free from mercurial vapor and the band is found to surround the whole of the least refrangible rays, and to unite itself with the band which surrounds the rays of greatest refrangibility. This band is not equally well defined throughout its whole extent. It is most evident from the extreme red to the green; it fades in passing through the blue, and increases again, as it leaves the indigo, until beyond the invisible chemical rays it is nearly as strong as it is at the calorific end of the spectrum.

Images on Daguerreotype plates which have been completely obliterated by rubbing may be restored, by placing it in a tolerably strong solution of iodine in water.

BROMIDE OF SILVER.—This salt, like the iodide, does not appear to be readily changed by the action of light; but when combined with the nitrate of silver it forms a very sensitive photographic preparation.

Paper prepared with this salt, blackens over its whole extent with nearly equal intensity, when submitted to the prismatic spectrum. The most characteristic peculiarity of the spectrum is its extravagant length. Instead of terminating at the mean yellow ray, the darkened portion extends down to the very extremity of the visible red rays. In tint it is pretty uniformly of a grey-black over its whole extent, except that a slight fringe of redness is

perceptible at the least refracted end. Beyond the red ray an extended space is protected from the agency of the dispersed light, and its whiteness maintained; thus confirming the evidence of some chemical power in action, over a space beyond the luminous spectrum, which corresponds with the rays of the least refrangibility.

This salt is extensively used in photographic drawing.

PREPARATIONS OF GOLD.—*Chloride of Gold,* freed from an excess of acid is slowly changed under the action of light; a regularly increasing darkness taking place until it becomes purple, the first action of the light being to whiten the paper, which, if removed from the light at this stage, will gradually darken and eventually develope the picture. This process may be quickened by placing the paper in cold water.

Chloride of gold with nitrate of silver gives a precipitate of a yellow brown color. Paper impregnated with the acetate of lead, when washed with perfectly neutral chloride of gold, acquires a brownish-yellow hue. The first impression of light seems rather to whiten than darken the paper, by discharging the original color, and substituting for it a pale greyish tint, which by slow degrees increases to a dark slate color; but if arrested, while yet not more than a moderate ash grey, and held in a current of *steam,* the color of the parts acted upon by light—and of that only—darkens immediately to a deep purple.

Here I must leave the subject of the action of light upon metalic compounds—referring to Mr. Hunts work for any further information the student may desire on the other metals—as I find myself going beyond my limits. I cannot, however, entirely dismiss the subject without giving a few examples of the action of light on the juices

of plants, some of which produce very good photographic effects.

CORCHORUS JAPONICA—The juice of the flowers of this plant impart a fine yellow color to paper, and, so far as ascertained, is the most sensitive of any vegetable preparation ; but owing to its continuing to change color even in the dark, photographic images taken on paper prepared with it soon fade out.

WALL FLOWER.—This flower yields a juice, when expressed with alcohol, from which subsides, on standing, a bright yellow finely divided fæcula, leaving a greenish-yellow transparent liquid, only slightly colored supernatant. The fæcula spreads well on paper, and is very sensitive to light, but appears at the same time to undergo a sort of chromatic analysis, and to comport itself as if composed of two very distinct coloring principles, very differently affected. The one on which the intensity and sub-orange tint of the color depends, is speedily destroyed, but the paper is not thereby fully whitened. A paler yellow remains as a residual tint, and this on continued exposure to the light, slowly darkens to brown. Exposed to the spectrum, the paper is first reduced nearly to whiteness in the region of the blue and violet rays. More slowly, an insulated solar image is whitened in the less refrangible portion of the red. Continue the exposure, and a brown impression begins to be percieved in the midst of the white streak, which darkens slowly over the region between the lower blue and extreme violet rays.

THE RED POPPY yields a very beautiful red color, which is entirely destroyed by light. When perfectly dried on paper the color becomes blue. This blue color is speedily discharged by exposure to the sun's rays, and papers prepared with it afford very interesting photographs.—

Future experiments will undoubtedly more fully develope the photogenic properties of flowers, and practically apply them.

Certain precautions are necessary in extracting the coloring matter of flowers. The petals of fresh flowers, carefully selected, are crushed to a pulp in a mortar, either alone or with the addition of a litte alcohol, and the juice expressed by squeezing the pulp in a clean linen or cotton cloth. It is then to be spread upon paper with a flat brush, and dried in the air. If alcohol be not added, it must be applied immediately, as the air changes or destroys the color instantly.

Most flowers give out their coloring matter to alcohol or water—but the former is found to weaken, and in some cases to discharge altogether these colors ; but they are in most cases restored in drying. Paper tinged with vegetable colors must be kept perfectly dry and in darkness.

To secure an eveness of tint on paper it should be first moistened on the back by sponging, and blotting off with bibulous paper. It should then be pinned on a board, the moist side downwards, so that two of its edges—the right and lower ones—project a little over those of the board. Incline the board twenty or thirty degrees to the horizon, and apply the tincture with a brush in strokes from right to left, taking care *not to go over* the edges which rests on the board, but to pass clearly over those that project ; and also observing to carry the tint from below upwards by quick sweeping strokes, leaving no dry spaces between them. Cross these with other strokes from above downwards, leaving no floating liquid on the paper. Dry as quickly as possible, avoiding, however, such heat as may injure the tint.

CHAP. IV.

A FEW HINTS AND SUGGESTIONS TO DAGUERREOTYPISTS.

There are very few who may not be capable of prac tising the Photographic art, either on paper, or metalic plates—but, like all other professions, some are more clever in its various processes than others.

Impatience is a great drawback to perfect success, and combined with laziness is a decided enemy. Besides this, no one can *excel* in Photography who does not possess a natural taste for the fine arts, who is not quick in discerning grace and beauty—is regardless of the principles of perspective, foreshorting and other rules of drawing, and who sets about it merely for the sake of gain—without the least ambition to rise to the first rank, both in its practice and theory. There is no profession or trade in which a slovenly manner will not show itself, and none where its effects will be more apparent than this.

In order to be great in any pursuit, we must be diligent, and keep all things, in order. In your show and reception rooms, let neatness prevail; have your specimens so placed—leaning slightly forward—as to obtain the strongest light upon them, and at the same time prevent that glassiness of apearance which detracts so materially from the effect they are intended to produce. If possible, let the light be of a north-western aspect, mel-

lowed by curtains of a semi-transparent hue. Your show-cases, at the door, should be kept well cleaned. I have often been disgusted while attempting to examine portraits in the cases of our artists, at the greasy coating and marks of dirty fingers upon the glass and frame enclosing them. Believe it, many a good customer is lost for no other reason.

In your operating room, dust should be carefully excluded. It should be furnished with nothing apt to collect and retain dust; a carpet is therefore not only a useless article, but very improper. A bare floor is to be prefered; but if you must cover it use matting. There is no place about your establishment where greater care should be taken to have order and cleanliness; for it will prevent many failures often attributed to other causes. "A place for every thing, and every thing in its place," should be an absolute maxim with all artists. Do not oblige the ladies, on going away from your rooms, to say—"That H. is a slovenly man; see how my dress is ruined by sitting down in a chair that looked as if it had just come out of a porter house kitchen and had not been cleaned for six months."

In choosing your operating room, obtain one with a north-western aspect, if possible; and either with, or capable of having attached, a large sky-light. Good pictures may be taken without the sky-light, but not the most pleasing or effective.

A very important point to be observed, is to keep the camera perfectly free from dust. The operator should be careful to see that the slightest particle be removed, for the act of inserting the plate-holder will set it in motion, if left, and cause those little black spots on the plate, by which an otherwise good picture is spoiled.

The camera should be so placed as to prevent the sun shining into the lenses.

In taking portraits, the conformation of the sitter should be minutely studied to enable you to place her or him in a position the most graceful and easy to be obtained. The eyes should be fixed on some object a little above the camera, and to one side—but never into, or on the instrument, as some direct; the latter generally gives a fixed, silly, staring, scowling or painful expression to the face. Care should also be taken, that the hands and feet, in whatever position, are not too forward or backward from the face when that is in good focus.

If any large surface of white is present, such as the shirt front, or lady's handkerchief, a piece of dark cloth (a temporary bosom of nankeen is best,) may be put over it, but quickly withdrawn when the process is about two thirds finished.

A very pleasing effect is given to portraits, by introducing, behind the sitter, an engraving or other picture—if a painting, avoid those in which warm and glowing tints predominate. The subject of these pictures may be applicable to the taste or occupation of the person whose portrait you are taking. This adds much to the interest of the picture, which is otherwise frequently dull, cold and inanimate.

Mr. J. H. Whitehurst of Richmond, Va., has introduced a revolving background, which is set in motion during the operation, and produces a distinctness and boldness in the image not otherwise to be obtained. The effect upon the background of the plate is equally pleasing; it having the appearance of a beautifully clouded sky.

In practising Photographic drawing on paper, the stu-

dent must bear in mind that it is positively essential, to secure success in the various processes, to use the utmost precaution in spreading the solutions, and washes from the combination of which the sensitive surfaces result. The same brush should always be used for the same solution, and never used for any other, and always washed in clean water after having been employed. Any metalic mounting on the brushes should be avoided, as the metal precipitates the silver from its solution. The brushes should be made of camels or badger's hair and sufficiently broad and large to cover the paper in two or three sweeps; for if small ones be employed, many strokes must be given, which leave corresponding streaks that will become visible when submitted to light, and spoil the picture.

These few preliminary hints and suggestions, will, I trust, be of some service to all who adopt this pleasing art as a profession; and will, with a due attention to the directions given in the practical working of the Daguerreotype, Calotype, etc., ensure a corresponding measure of success.

CHAP. V.

DAGUERREOTYPE APPARATUS.

The entire Daguerreotype process is comprised in seven distinct operations; viz:

1.—*Cleaning and polishing the plate.*

2.—*Applying the sensitive coating.*

3—*Submitting the plate to the action of light in the camera.*

4.—*Bringing out the picture; in other words rendering it visible.*

5.—*Fixing the image, or making it permanent—so that the light may no longer act upon it.*

6.—*Gilding: or covering the picture with a thin film of gold*—which not only protects it, but greatly improves its distinctness and tone of color.

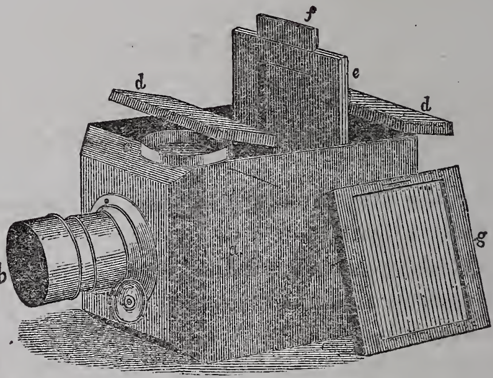
7.—*Coloring the picture.*

For these various operations the following articles—which make up the entire apparatus of a Daguerrean artist—must be procured.

1.—The Camera.—(*Fig.* 5.). The Camera Obscura of the Italian philosophers, although highly appreciated, on account of the magical character of the pictures it produced, remained little other than a scientific toy, until the discovery of M. Daguerre. The value of this instrument is now great, and the interest of the process which it so

essentially aids, universally admitted. A full description of it will therefore be interesting.

FIG. 5.

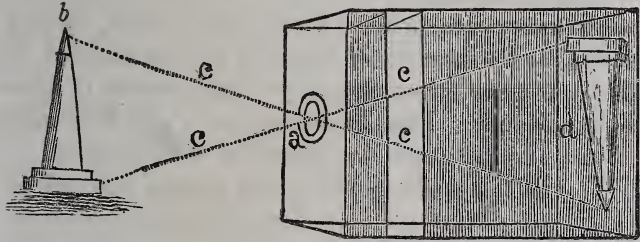


The camera is a dark box (a), having a tube with lenses (b) placed in one end of it, through which the radiations from external objects pass, and form a diminished picture upon the ground glass (g) placed at the proper distance in the box to receive it; the cap c covering the lenses at b until the plate is ready to receive the image of the object to be copied.

Thus a (*fig.* 6.) representing the lens, and b the object desired to be represented, the rays (c, c) proceeding from it fall upon the lens, and are transmitted to a point, which varies with the curvature of the glass, where an inverted image (d) of b is very accurately formed. At this point, termed the focus, the sensitive photographic material is placed for the purpose of obtaining the required picture.

The great desideratum in a photographic camera is perfect lenses. They should be achromatic, and the utmost

Fig. 6.



transparency should be obtained; and under the closest inspection of the glass not the slightest wavy appearance, or dark spot should be detected; and a curvature which as much as possible prevents spherical aberration should be secured. The effect produced by this last defect is a convergence of perpendiculars, as for instance; two towers of any building, would be represented as leaning towards each other; and in a portrait the features would seem contracted, distorted and mingled together, so as to throw the picture out of drawing and make it look more like a caricature than a likeness. If the lens be not achromatic, a chromatic aberration takes place, which produces an indistinct, hazy appearance around the edges of the picture, arising from the blending of the rays.

The diameter and focal length of a lens must depend in a great measure on the distance of the object, and also on the superficies of the plate or paper to be covered. For portraits one of 1½ inches diameter, and from 4½ to 5½ inches focus may be used; but for distant views, one from 2 inches to 3 inches diameter, and from 8 to 12 inches focal length will answer much better. For single lenses, the aperture in front should be placed at a distance

from it, corresponding to the diameter, and of a size not more than one third of the same. A variety of movable diaphrams or caps, to cover the aperture in front, are very useful, as the intensity of the light may be modified by them and more or less distinctness and clearness of delineation obtained. These caps alway come with Voitlander instruments and should be secured by the purchaser.

Though the single acromatic lens answers very well for copying engravings; taking views from nature or art, for portraits the double should always be used. The extensive manufacture of the most approved cameras, both in Europe and in this country, obviates all necessity for any one attempting to construct one for their own use. Lenses are now made so perfect by some artisans that, what is called the " quick working camera " will take a picture in one second, while the ordinary cameras require from eight to sixty.

The camera in most general use is that manufactured by Voigtlander and Son of Germany. Their small size consists of two seperate acromatic lenses; the first, or external one, has a free aperture of 1½ inches; the second, or internal, 1⅝ inches; and both have the same focus, viz: 5¾ inches. The larger size differs from the smaller. The inner lens is an achromatic 3¼ inches diameter, its focal length being 30 inches. The outer lens is a meniscus—that is bounded by a concave and convex spherical surface which meet—having a focal length of 18 inches. For every distant view, the aperture in front is contracted by a diaphram to ⅛ of an inch. By this means the light is reflected with considerable intensity and the clearness and correctness of the pictures are truly surprising.

THE AMERICA instruments are constructed on the same

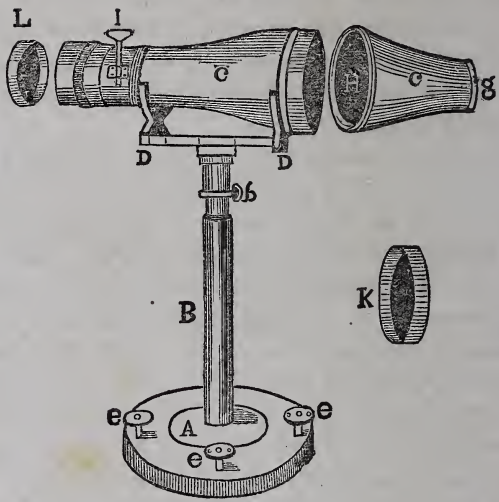
principle and many of them are equally perfect. Mr. Edward Anthony of 205 Broadway, New York city, has constructed, and sold cameras fully equal to the German and for which Voigtlander instruments have been refused in exchange by the purchaser.

The ordinary camera box (*see fig.* 5, *a*) varies in size to suit the tube, and is termed medium, half, or whole Within the box is a slide to assist in regulating the focus, and in enlarging or diminishing the picture. In one end of this slide is a springed groove into which the ground-glass spectrum (*g fig.* 5) is slid, for the purpose of more conveniently arranging the focus. After the plate is prepared it is placed in the holder—partly seen at *e*, fig. 5, and covered with the dark slide *f*, fig. 5; the spectrum is then withdrawn and the holder takes its place, and the lids *d*, *d*, are closed after removing the dark slide *f*. The plate is now ready to receive the image, and the cap *c* may be removed to admit the light into the box.

A camera constructed by Voigtlander is thus described by Mr. Fisher. "It is made entirely of brass, so that variations of climate has no effect upon it. It is very portable and when packed in its box, with all the necessary apparatus and materials for practising the Daguerreotype art, occupies but very little space. It is not, however, well adapted for the Calotype process."

"The brass foot A (fig. 7.), is placed on a table, or other firm support, and the pillar B. screwed into it; the body of the camera, *C*, *C* is laid into the double forked bearing *D*. *D*. The instrument is now properly adjusted by means of the set screws, *e*, *e*, *e*, in the brass foot, or it may be raised, lowered, or moved, by the telescope stand, and when correct, fixed by the screw *b*. The landscape to be delineated is viewed either through the

Fig. 7.



small lens, *g*, or with the naked eye on the ground glass plate *H*, the focus being adjusted by the screw *I*. The optical part of the instrument consist of the small set of achromatic lenses already described. When the portrait or view is deleniated on the ground glass to the entire satisfaction of the operator, the brass cap *L* is placed over the lens, and the entire body is removed away into the dark, taking care not to disturb the position of the stand. The body is now detached at the part *H*, and the prepared paper or plate enclosed in the brass frame work introduced in its place; the whole is again placed upon the pedestal, the brass cap *L* is removed, by which the paper or plate is exposed to the full influence of the light, after which the cap is again replaced.

Mr. Woodbridge, of this city, has constructed an instrument for taking full length portraits on plates 10 by

13 inches, which is worthy of some notice. It is a double camera, consisting of two boxes, placed in a frame, one above the other, and so arranged as to slide easily up and down. After the focus has been adjusted, on the object, in both cameras, the plate is put into the upper box, in the manner already described, until the superior portion of the figure is complete; it is then placed in the second box and the lower extremities obtained. The adjustment of the instrument is so complete that a perfect union of the parts is effected in the picture without the least possible line of demarkation being visible. Fig. 8 gives a front view of this instrument.

Fig. 8.

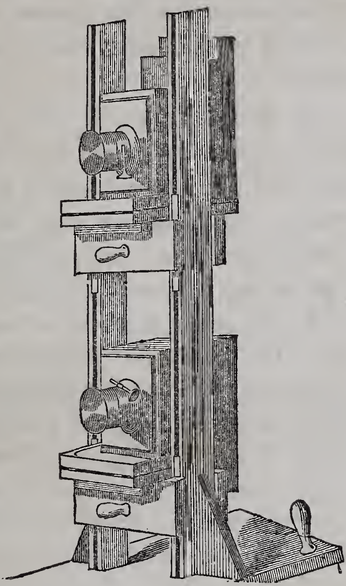
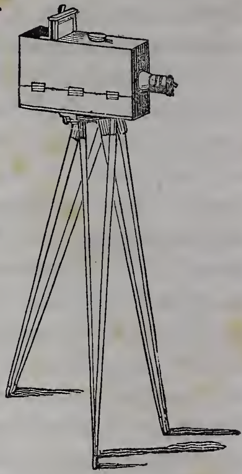


Fig. 9 represents Talbot's Calotype Camera,—a very beautiful instrument.

The *copying* camera box has an extra slide in the back end, by which it may be considerably lengthened at pleasure.

II.—Camera Stand.—The best constructed stands are made of maple or blackwallnut wood, having a cast iron socket (*a*, fig. 12,) through which the sliding rod *b* passes, and into which the legs *c*, *c*, with iron screw ferules are inserted. The platform *d* is made of two pieces, hinged

Fig. 9.



together, as at *e*, and having a thumb screw for the purpose of elevating or depressing the instrument.

III. Mercury bath.—Fig. 13 gives a front view of the mercury bath now in general use in this country for mercurializing and bringing out the picture. It is quite an improvement on those first used. To make it more portable it is in three pieces, *a b* and *c*; having a groove *e* on one side to receive the thermometre tube and scale by which the proper degree of heating the mercury is ascertained. Into the top are nicely fitted two or three iron frames, with shoulders, for the plate to rest in, suitable for the different sizes of plates. The bath is heated by means of a spirit lamp placed under it. From two to four ounces of highly purified mercury are put into the bath at a time.

IV. Plate blocks and vices.—There are several kinds of this article in use; I shall describe the two best only.

Fig. 10.

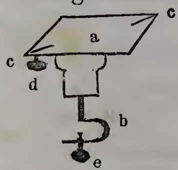


Fig. 10 gives an idea of the improvement on the English hand block. The top *a* is perfectly flat and smooth—a little smaller than the plate, so as to permit the latter to project a very little all around—having at opposite angles *c c* two clasps, one fixed the other moveable, but capable of being fastened by the thumb screw *d*, so as to secure the plate tightly upon the block. This block turns upon

a swivle, *b*, which is attached to the table by the screw *c*, This block is only used for holding the plate while undergoing the first operation in cleaning.

Fig. 11.

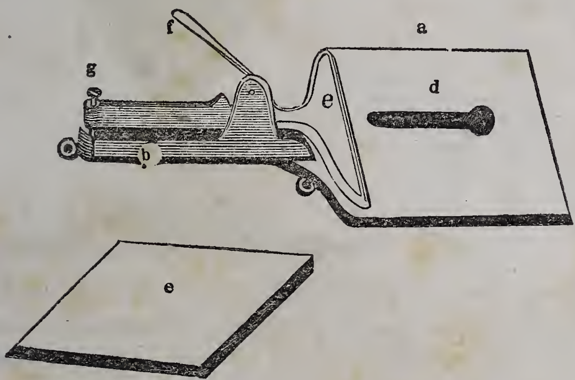


Fig. 11, shows the form of Lewis' newly patented plate vice, which for durability, simplicity and utility is preferable to all others. It consists of a simple platform and arm of cast iron, the former, *a*, having a groove, *d*, in the centre for fixing the different sizes of plate beds, *e* —and the latter supporting the levers *e f*. On this vice which is secured to a table, or bench, the plate receives its finishing polish with rouge, or prepared lampblack. Mr. Lewis gives the following directions for its use. "As the cam wears tighten it with the adjusting screw (*g*) so as to allow the lever (*f*) to fall back into a horizontal position; the plate being in its place at the time. Oil the wearing parts occasionally."

Some Daguerreotypists, however, use a foot lathe with buff wheels of various forms; but this vice is sufficient for all ordinary purposes.

V. Coating boxes.—The usual form for iodine and

FIG. 12.

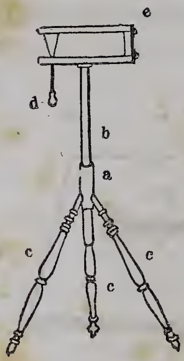
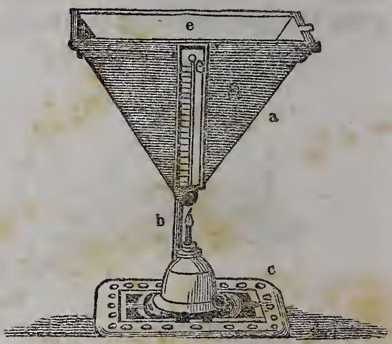


FIG. 13.

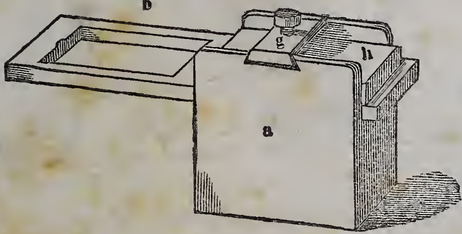


bromine boxes is seen at figs. 14 and 15. They are far superior to those in use with the English operators. Each consists of a wooden box (*a*,) having firmly embeded within it a stout glass jar (*c*), the edges of which are ground. Over this is placed the sliding cover *b*, double the length of the box, one half occupied by a piece of ground glass (*e*), tightly pressed upon the glass pot by a spring (*i*) beneath the cross bar *g*, and fits the pot so accurately that it effectually prevents the escape of the vapor of the iodine, bromine or other accelerating liquid contained therein. The other half of the lid is cut through, shoulders being left at the four angles for the different sizes of frames, designed to recieve the plate while undergoing the coating process. When the plate is put into the frame, the cover *b* is shoved under the second lid *h* and when coated to the proper degree, it resumes its former position and the plate is placed in the holder of the camera box. To test the tightness of the box, light a piece of paper, put it into the pot and cover it with the sliding lid. The burning paper expels

the air from the pot, and if it be perfectly tight you may raise the whole box by the lid.

VI. Glass Funnels.—Are a necessary article to the Daguerreotypist, for filtering water, solutions, &c.

Fig. 14.

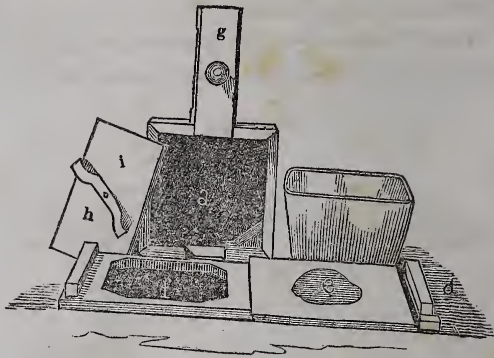


VII. Gilding Stand.—For nervous persons the gilding stand is a useful article. It is adjusted to a perfect level by thumb screws placed in its base.

VIII. Spirit lamps.—The most useful and economical of those made are the Britania, as they are less liable to break; and the tube for the wick being fastened to the body by a screw renders it less liable to get out of order or explode. Glass is the cheapest, and for an amateur will do very well, but for a professed artist the Baitania should always be obtained.

IX. Color Box.—These are generally found on sale at the shops, and usually contain eight colors, four brushes and a gold cup. The artist would, however, do well to obtain, all the colors mentioned in the last chapter of this work, and be sure to get the very best, as there are various qualities of the same color, particularly carmine, which is very expensive, and the cupidity of some may induce them to sell a poor article for the sake of larger profits.

Fig. 15.

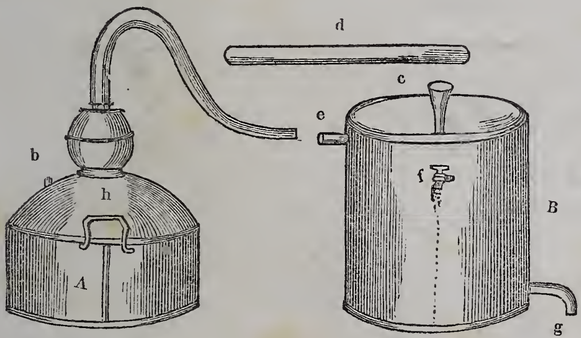


Still.—Daguerreotypists should always use distilled water for solutions, and washing the plate, as common water holds various substances in solution which detract very materially from the excellence of a photograph, and often gives much trouble, quite unaccountable to many. For the purpose of distilling water the apparatus represented at Fig. 16 is both convenient and economical.

It may be either wholly of good stout tin, or of sheet iron tinned on the inside, and may be used over a common fire, or on a stove. *A* is the body, which may be made to hold from one to four gallons of water, which is introduced at the opening *b*, which is then stopped by a cork. The tube *d* connects the neck *a* of the still with the worm tub, or refrigerator *B*, at *e*, which is kept filled with *cold* water by means of the funnel *c*, and drawn off as fast as it becomes warm by the cock *f*. The distilled water is condensed in the worm—and passes off at the cock *b*, under which a bottle, or other vessel, should be placed to receive it. The different joints are rendered tight by lute, or in its absence, some stiff paste spread upon a piece of linen and wrapped around them will an-

swer very well ; an addition of sealing wax over all will make them doubly secure.

FIG. 16.



HYGROMETER.—This is an instrument never to be found, I believe, in the rooms of our operators, although it would be of much use to them, for ascertaining the quantity of moisture floating about the room ; and as it is necessary to have the atmosphere as dry as possible to prevent an undue absorption of this watery vapor by the iodine &c., and to procure good pictures,—its detection becomes a matter of importance. Mason's hygrometer, manufactured by Mr. Roach and sold by Mr. Anthony, 205 Broadway, New York is the best in use.

It consists of two thermometre tubes placed, side by side, on a metalic scale, which is graduated equally to both tubes. The bulb of one of these tubes communicates, by means of a net-work of cotton, with a glass reservoir of water attached to the back of the scale. Fig. 17 and 18 represent a front and back view of this instrument.

Fig. 17 is the front view, showing the tubes with their respective scales ; the bulb *b* being covered with the net-work of cotton communicating with the reservoir *c* fig.

FIG. 17

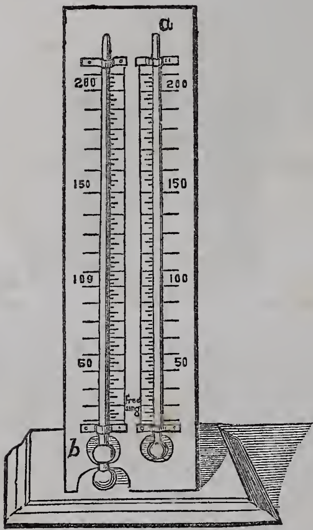
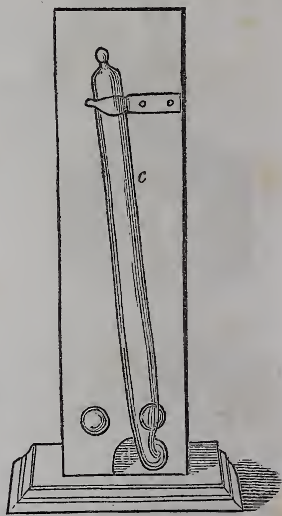


FIG. 18.



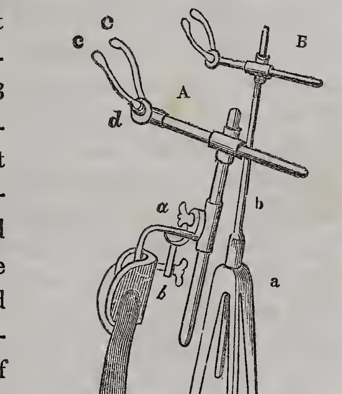
18, at *d*. The evaporation of the water from this bulb decreases the temperature of the mercury in the tube *b* in proportion to the dryness of the atmosphere, and the number of degrees the tube *b* indicates below that of the other, shows the real state of the atmosphere in the room ; for instance, if *b* stands at forty and *a* at sixty-one the room is in a state of extreme dryness, the difference of twenty-one degrees between the thermometers—let *a* stand at any one point—gives this result. If they do not differ, or there is only four or five degrees variation, the

atmosphere of the room is very moist and means should be taken to expel the superfluous quantity.

HEAD RESTS.—The button head rest with chair back clip, A fig. 19—is much the best for travelling artists, as it can be taken apart, into several pieces and closely packed, is easily and firmly fixed to the back of a chair by the clamp and screw *a* and *b*, and is readily adjusted to the head, as the buttons *c*, *c* and arms *d*, *d* are movable.

Sometimes the button rest is fixed to a pole, which is screwed to the chair; but this method is not so secure and solid as the clip and occupies more room in packing. Both the pole and clip, are furnished in some cases with brass band rests instead of the button; but the only recommendation these can possibly possess in the eyes of any artist, is their cheapness.

FIG. 19.

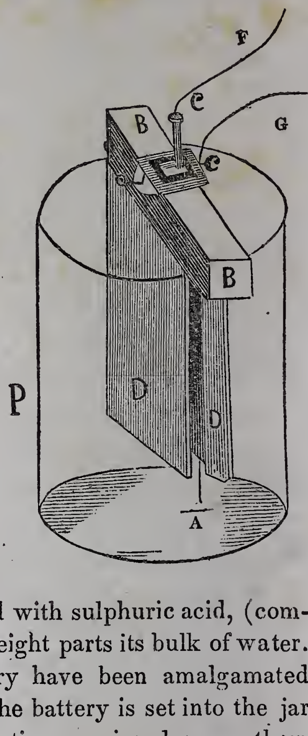


For a Daguerreotypist permanently located the independent iron head-rest, B fig. 19, is the most preferable, principally on account of its solidity. It is entirely of iron, is supported by a tripod *a*) of the same metal and can be elevated by means of a rod (*b*) passing through the body of the tripod, to a height sufficient for a person, standing, to rest against.

GALVANIC BATTERY.—This article is used for the purpose of giving to imperfectly coated plates a thicker covering of silver. The form of battery now most uni-

versally employed for electrotype, and other galvanic purposes, is Smee's—Fig. 20. It consists of a piece of platinized silver, A, on the top of which is fixed a beam of wood, B, to prevent contact with the silver. A binding screw C is soldered on to the silver plate to connect it with any desired object, by means of the copper wire, *e*. A plate of amalgamated zinc, D, varying with the fancy of the operator from one half to the entire width of the silver, is placed on each side of the wood. This is set into a glass vessel, P,—the extreme ends of the wood resting upon its edge—on which the acid with which it is charged has no effect. The jar is charged with sulphuric acid, (common oil of vitriol) diluted in eight parts its bulk of water. The zinc plates of the battery have been amalgamated with quicksilver, and when the battery is set into the jar of acid there should be no action percieved upon them when the poles F, G, are not in contact. Should any action be percieved, it indicates imperfect amalgamation; this can be easily remedied by pouring a little mercury upon them immediately after removing them from the acid, taking care to get none upon the centre plate A.

Fig. 20.



Directions for use.—A sheet of silver must be attached to the wire connected with the centre plate A of the

battery, and placed in the silver solution—prepared as directed below. The plate to be silvered is first cleaned with diluted sulphuric acid, and then attached to the wire, G, proceeding from the zinc plates D, D, and placed in the silver solution, opposite the silver plate attached to the pole F, and about half an inch from it. A slight effervescence will now be percieved from the battery, and the silver will be deposited upon the Daguerreotype plate, while at the same time a portion of the silver plate is dissolved.

To prepare the solution of silver.—Dissolve one ounce of chloride of silver in a solution of two ounces of cyanide of potassium, previously dissolved in one quart of water. The oxide of silver may be used instead of the chloride. This solution is put into a tumbler, or other vessel.

FIG. 21.

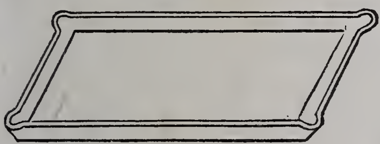
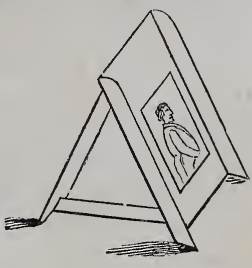


FIG. 22.



This battery with the necessary articles for using it may be obtained of E. Anthony, 205 Broadway, New York city.

The other articles required by every operator may be simply enumerated, viz :

Sticking, or sealing paper.

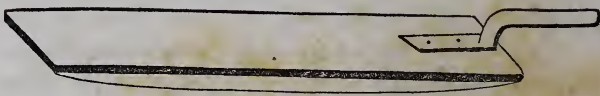
A pair of plyers, or forceps.

Porcelain pans or dishes, for applying the hyposul-

phite of soda and washing after the imagine is fixed, something in form like fig. 21.

A support for holding the plate while being washed, like fig. 22

Fig. 23.



Buff Sticks.—*Fig.* 23.—These are usually from one to three feet in length, and about three inches wide—some think two and a half sufficient. The underside, which is convex, is covered with a strip of finely prepared buckskin, or velvet, well padded with cotton or tow.

All the articles enumerated in this chapter may be obtained, of the very best quality and at the most reasonable rates, of Mr. E. Anthony, 205 Broadway, New York.

CHAP. VI.

THE DAGUERREOTYPE PROCESS.

The process of taking Daguerreotype pictures differs very materially from all others of the photographic art, inasmuch as the production of the image is effected upon plates of copper coated with silver. The silver employed should be as pure as possible; the thickness of the plate is of little consequence, provided there be sufficient silver to bear the cleaning and polishing—is free from copper spots, is susceptible of a high polish, an exquisitely sensitive coating and a pleasing tone. These qualities are possessed to an eminent degree by the French plates.

Having already enumerated the various processes—and the apparatus necessary for the manipulation, I will here give a list of the chemicals to be used, and then proceed to explain them more fully. The requisite chemicals are—

NITRIC ACID,	ROUGE,
DRY IODINE,	MERCURY,
DRYING POWDER,	HYPOSULPHITE OF SODA,
CYANIDE OF POTASSIUM,	CHLORIDE OF GOLD; OR
ROTTENSTONE,	HYPOSULPHITE OF GOLD.
TRIPOLI,	CHLORIDE OF SILVER.

CHLORIDE OF IODINE, } their compounds, or other accelerating mixtures.
BROMINE }

FIRST OPERATION.—*Cleaning and polishing the plate.*—For this purpose the operator will require the—

Plate Blocks,

Plate Vice

Spirit Lamp,

Polishing Buffs,

Nitric Acid, diluted in fifteen times its bulk of water

Galvanic Battery, to galvanize the plate, as directed in the last chapter if it is to imperfect to be used without, previous to cleaning it.

Rottenstone,

Tripoli, which is too often dispensed with.

Rouge, or lampblack—the first being most preferable. The English operators mix the two together.

Prepared cotton Wool, or Canton flannel. If the first is used, it should be excluded from the dust, as it is not so easily cleansed as the latter.

The plate is secured, with its silver side upward, to the block, by the means described on page 58—having previously turned the edges backward all around. The amount of cleaning a plate requires, depends upon the state it is in. We will suppose one in the worst condition; dirty, scratched, and full of mercury spots, all of which imperfections are more or less to be encountered. The mercury spots are to be removed by burning the plate. To do this hold the plate over the flame of a spirit lamp, more particularly under the mercury spots, until they assume a dull appearance, when the lamp is to be removed, and the plate allowed to cool, after which it is attached to the block.

Place the block upon the swivle, and hold it firmly with the left hand; take a small knot or pellet of cotton, or, if you like it better, a small piece of canton flannel—wet it with a little diluted nitric acid; then sift some fine-

ly prepared rottenstone—Davie's,* if you can get it—upon it, and rub it over the plate with a continual circular motion, till all traces of the dirt and scratches are removed; then wipe off the rottenstone with a clean piece of cotton, adopting, as before, a slight circular motion, at the same time wiping the edges of the plate. Even the back should not be neglected, but throughly cleansed from any dirt or greasy film it may have received from handling.

When this is thoroughly accomplished, mix a portion of your tripoli with the dilute nitric acid, to the consistence of thick cream. Then take a pellet of cotton and well polish the plate with this mixture, in the same manner as with the rottenstone. Continue the process till, on removing the tripoli with a clean pellet, the plate exhibits a clear, smooth, bright surface, free from all spots, or scratches. Any remains of the acid on the plate may be entirely removed by sifting on it a little Drying powder, and then wiping it carefully off with a fine camels hair brush, or duster. The finishing polish is now to be given.

For this purpose the rouge—or a mixture of rouge and lamp-black, in the proportion of one part of the former to seven of the latter—is used. It should be kept either in a muslin bag, or wide mouth bottle, over which a piece of muslin is tied—in fact, both the rottenstone and tripoli should be preserved from the dust in the same manner. With a little of this powder spread over the buff—described on page 60—the plate recieves its final polish; the circular motion is changed for a straight one across the plate, which, if intended for a portrait, should be buffed the narrow way; but if, for a landscape or view of a house, the length way of the plate.

* Sold by E. Anthony.

The operation of cleaning the plate at first appears difficult and tedious, and many have been deterred from attempting this interesting art on that account; but, in reality, it is more simple in practice than in description, and with a little patience and observation, all difficulties are easily overcome. Great care must be taken to keep the buff free from all extraneous matter, and perfectly dry, and when not in use it should be wrapped up in tissue paper, or placed in a tight box.

The plate should be buffed immediately before the sensitive coating is given; particles of dust are thus effectually removed; the temperature of the plate is also increased by the friction, and the required tint more readily obtained.

SECOND OPERATION.—*Applying the sensitive coating.*—The apparatus and chemicals required, are an

Iodine box—see fig. 14 *page* 53.

Bromine box—similar to the iodine box, but a trifle deeper.

Dry Iodine.

Bromine, or a compound of Bromine and Chloride of Iodine, or other sensitive mixture.

Most of our best operators use the compound Bromine and Chloride of Iodine. In the early days of the Daguerreotype, Iodine alone was used in preparing the plate, and although it still plays a very important part, other preparations, called accelerating liquids, quickstuff, &c., are used, and the discovery of which has alone ensured the application of the Daguerreotype successfully to portrait taking—for when first introduced among us it took from five to ten minutes to produce a tolerable good view, while now but the fraction of a minute is required to obtain an accurate likeness.

To iodize the plate perfectly it must be placed over the iodine vapor immediately after buffing. Scatter from a sixteenth to the eighth of an ounce of dry iodine over the bottom of your coating box, and slightly cover it with cotton wool. The plate is then dropped into the frame *b*, *fig.* 14, with its silvered surface downward, and thrust under the lid *h*. The bright surface of the plate is soon coated with a film of iodine of a fine yellow color; it is then removed and placed over the accelerating solution. It is not absolutely necessary to perform this operation in the dark, although a bright light should be avoided. Not so the next part of the process, viz; giving the plate its extreme sensitiveness, or coating with the accelerating liquids. In this great caution should be used to prevent the slightest ray of light impringing directly on the plate, and in examining the color reflected light should always be used. A convient method of examining the plate, is to make a small hole in the partition of the closet in which you coat, and cover it with a piece of tissue paper; by quickly turning the plate so that the paper is reflected upon it the color is very distinctly shown. Most of our operators are not so particular in this respect as they should be.

ACCELERATING LIQUIDS.—Of these there are several kinds, which differ both in composition and action—some acting very quickly, others giving a finer tone to the picture although they are not so expeditious in there operations; or in other words, not so sensitive to the action of light. These are adopted by Daguerreotypists according to their tastes and predjudices. They are all applied in the same way as the coating of iodine. The following are the best.

Bromine water—This solution is much used in France,

and, I shall therefore give its preparation, and the method of using it, in the words of M. Figeau. " Put into a bottle of pure water, a large excess of bromine; shake the mixture well, and before using it, let all the bromine be taken up. An ascertained quantity of this saturated water is then diluted in a given quantity of distilled water, which gives a solution of bromine that is always identical. " M. Figeau recommends one part of the saturated solution to thirty parts its bulk of water ; but M. Lesebour finds it more manageable if diluted with forty times. In case pure distilled, or rain water cannot be procured, a few drops of nitric acid—say six to the quart—should be added to the common water.

Put into the bromine box a given quantity of this solution, sufficient to well cover the bottom ; the plate, having been iodized to a deep yellow, is placed over it; the time the plate should be exposed must be ascertained by making a few trials ; it averages from twelve to forty seconds. When once ascertained, it is the same for any number of plates, as the solution, which of course would become weaker and weaker, is changed after every operation, the same quantity being always put into the pot.

Chloride of Iodine.—This is prepared by introducing chlorine gass into a glass vessel containing iodine ; the iodine is liquified, and the above named compound is the result. Operators need not, however, be at the trouble and expense of preparing it, as it can be obtained prefectly pure of Mr. Anthony, 205 Broadway, N. Y., as also all of the chemicals herein enumerated. The compound is diluted with distilled water, and the plate submitted to its action till it is of a rose color. Chloride of iodine alone, is seldom if ever used now by American operators, as it does not sufficiently come up to their locomotive princi

ple of progression. The next is also eschewed by the majority, although many of our best artists use no other, on account of the very fine tone it gives to pictures.

Bromide of Iodine.—This is a compound of bromine and chloride of iodine. In mixing it, much depends upon the strength of the ingredients; an equal portion of each being generally used. Perhaps the best method of preparing it, is to make a solution in alcohol of half an ounce of chloride of iodine, and add the bromine drop by drop, until the mixture becomes of a dark red color; then dilute with distilled water, till it assumes a bright yellow. Put about half an ounce of this compound into the pot, and coat over it to a violet color, change the solution when it becomes too weak to produce the desired effect.

Another.—Mix half an ounce of bromine with one ounce of chloride of iodine, add two quarts pure distilled water, shake it well and let it stand for twelve hours; then add twenty-five drops of muriatic acid, and let it stand another twelve hours, occasionally shaking it up well. Dilute six parts of this solution in sixteen of water. Coat over dry iodine to a deep yellow, then over the sensitive to a deep rose color—approaching purple—then back, over dry iodine from four to eight seconds.

Roach's Tripple Compound.—This is one of the very best sensitive solutions, and is very popular among Daguerreotypists. To use this, take one part in weight, say one drachm, of the compound and dilute it with twelve of water; coat over dry iodine to yellow, then over the compound to a rosy red. The effect in the camera is quick, and produces a picture of a fine white tone.

Gurney's Sensitive.—This is another preparation of

bromine, and gives a fine tone. To two parts of water add one of the sensitive, and put just sufficient in the box to cover the bottom, or enable you to coat in from eight to ten seconds. Coat over dry iodine to a dark yellow, and over the quick till you see a good change, then back over the dry iodine from two to three seconds.

Bromide of Lime, or Dry Sensitive.—This is a compound but recently introduced, and is becoming somewhat of a favorite, owing principally to the slight trouble it gives in its preparation, and the tone it imparts to the picture. To prepare it, fill your jar about half or quarter full of dry slacked lime, then drop into it bromine, till it becomes a bright orange red. The plate is generally coated over this compound, after the iodine coating to yellow, to a violet, or plum color ; but it will work well under any circumstances, the color being of little consequence, if coated from thirty to ninety seconds, according to its strength.

Mead's Accelerator.—I merely mention this as being in the market, not knowing any thing in regard to its merits. The directions given for its use are as follows : Mix one-third of a bottle with a wine glass full of water, coat the plate over dry iodine to a dark gold color, then over the accelerator to a violet, then back over dry iodine, or chloride of iodine, from three to five seconds.

Chloride of Bromine.—M. Bissou, a French experimentalist, has found that bromine associated with chlorine, prepared in a similar manner to chloride of iodine, already described, a solution of bromine being substituted for the iodine, is a very sensitive solution ; by means of it daguerreotype proofs are obtained in half a second, and thus very fugitive subjects are represented, making it the very best compound for taking children. So quick is its

operation, that even persons or animals may be taken in the act of walking.

Hungarian Liquid.—This, I believe, has never been used here, or imported into this country, and the composition of it is not generally known, even in Europe, where it has taken precedence of all others. It acts quickly and with considerable certainty. It is used by diluting it with from ten to fifteen times its bulk of water, putting a sufficient quantity into the jar to cover the bottom. The plate being previously iodized to a light yellow, is submitted to this mixture till it assumes a light rose tint.

Bromine and Fluoric Acid, in combination, are used by some Daguerrean artists as a sensitive, but any of the above compounds are better; besides this, the fluoric acid is a dangerous poison, and the quick made from it will not repay the risk to the health in using it.

As I have before said, great caution should be observed in examining the color of the plate, even by the feeble light allowed, which, when attained, must be immediately placed in the holder belonging to the camera and covered with the dark slide. You then pass to the

THIRD OPERATION.—*Submitting the Plate to the action of Light in the Camera.*—Experience alone must guide the operator as to the time the plate should be exposed to the influence of the light; this being dependent on a variety of circumstances, as clearness of the atmosphere—and here, a reference to the hygrometer will be of advantage—time of day, object to be taken, and the degree of sensitiveness imparted to the plate by the quick-stuff. As I have before said, the artist should be careful to see that the interior of the camera is clean and free from dust, as the small particles flying about, or set in

motion by the sliding of the holder into the box, attach themselves to the plate, and cause the little black spots, by which an otherwise good picture is frequently spoiled. Care should also be taken in withdrawing the dark slide, in front of the plate, from the holder, as the same effect may be produced by a too hasty movement. The lens is the last thing to be uncovered, by withdrawing the cap *c*. fig. 5., which should not be done until you have placed the sitter in the most desirable position. When, according to the judgment and experience of the operator, the plate has remained long enough to receive a good inpression, the cap is replaced over the lens, and the dark slide over the plate, which is then removed from the camera.

Daguerreotypists generally mark time by their watches, arriving at the nearest possible period for producing a good picture by making several trials. As a ready method of marking short intervals of time is, however, a very important consideration, and as any instrument which will enable an artist to arrive at the exact period, must be an improvement, and worthy of universal adoption, I will here describe one invented by Mr. Constable of England, which he calls a

Sand Clock, or Time Keeper.—" It consists of a glass tube, about twelve inches long by one in diameter, half filled with fine sand, similar to that used for the ordinary minute glasses, and, like them, it has a diaphram, with a small hole in the centre through which the sand runs. The tube is attached to a board which revolves on a centre pin ; on the side is a graduated scale, divided into half seconds ; the tube is also provided with a moveable index. This instrument is attached, in a conspicuous place, to the wall. The glass tube being revolved on its centre, the index is set to the number of half seconds re

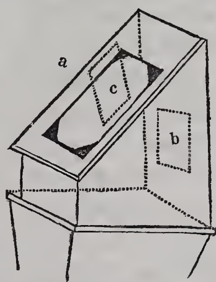
quired, and the sand running down, the required time is marked without the possibility of error. In practice it will be found to be a far more convenient instrument for the purpose than either a clock or a seconds watch, and is applicable both for the camera and mercury box."

If the artist finds it desirable or necessary to take the object to be copied in its right position, that is reverse the image on the spectrum, he can do so by attaching a mirror (which may be had of Mr. Anthony, or Mr. Roach) to the camera tube, at an angle of forty-five degrees.

If, after taking the plate from the camera, it be examined, no picture will yet be visible, but this is brought about by the

FOURTH PROCESS.—*Bringing out the Picture, or rendering it Visible.*—We now come to the use of the mercury bath, Fig. 13. To the bath a thermometer is attached, to indicate the proper degree of heat required, which should never be raised above 170° Fahrenheit. The plate may be put into one of the frames (see Fig. 13,) over the mercury, face downwards, and examined from time to time, by simply raising it with the fingers, or a pair of plyers. This operation, as well as the others, should take place in the dark closet. Sometimes, to prevent the necessity of raising the plate, an additional cover or top is made use of. It consists of a box fitted closely to the inner rim of the bath, and having an inclined top (a, Fig. 24.) The top is cut through and fitted with frames for each size of plate, like those already described, and in the back is a piece of glass (b,) through which to view the progress

FIG. 24.



of mercurialization, and an additional piece (c,) on one side, colored yellow, to admit the light. The outline only of the top is here given, in order to show every portion of it at one view.

The picture, being fully developed, is now taken out and examined; it must not, however, be exposed to too strong a light. If any glaring defects be perceived, it is better not to proceed with it, but place it on one side to be re-polished ; if, on the contrary, it appears perfect, you may advance to the

FIFTH OPERATION.—*Fixing the Image so that the light can no longer act upon it.*—The following articles are required for this purpose :

Two or three porcelain or glass dishes, in form, something like fig. 21.

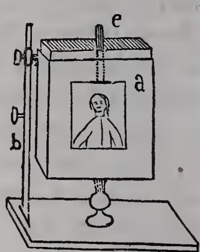
A plate support, fig. 22. Few, I believe, now make use of this, although it is a very convenient article.

Hyposulphite of Soda,

A pair of Plyers.

In Europe, they also use a drying apparatus, Fig 25, but this, like the plate support, is a matter of little consequence, and may be dispensed with. I will, however, describe it, for the benefit of those who may wish to use it.

FIG. 25.



A vessel made of copper or brass, tinned inside, and large enough to take in the largest plate, but not more than half an inch wide, is the most convenient. It must be kept perfectly clean. Hot distilled water is poured into it, and the temperature kept up by a spirit lamp.

Hyposulphite of Soda.—Having made a solution of

hyposulphite of soda, and well filtered it—the strength is immaterial: about half an ounce of the salt to a pint of distilled water is sufficient—pour it into one of the porcelain dishes, put into another plain, and into a third distilled water. Immerse the plate with its face downwards into the hyposulphite, and the whole of the sensitive is removed, and the light has no farther action upon it; it is then to be removed from the hyposulphite and plunged into the plain water, or placed upon the support, fig. 22, and the water poured over it. It is then washed in a similar manner with the distilled water and well examined, to see that not the slightest particle of dust rests on the suface. The next step is to dry it.

This may be readily accomplished by holding the plate with your plyers,and pouring distilled water over it—if it is hot, so much the better. Apply the spirit lamp to the back, at the corner held by the plyers, at the same time facilitating the operation with the breath; pass the lamp gradually downwards, finishing at the extreme corner. The last drop may now be removed by a little bibulous paper. A single drop, even, of distilled water allowed to dry on any part of the surface, is certain to leave a stain which no after process can remove.

To illustrate the necessity for having perfectly clean water, and free from all foreign matter—only to be avoided by using that which is distilled—in these processes, I will relate a little anecdote.

An operator in this city (New York) frequently made complaint to me, that his plates were occasionally very bad; coming out all over in little black and white spots, and spoiling many very good pictures, regretting at the same time that perfect plates were not made, for he had

lost many customers in consequence of these defects. These complaints being somewhat periodical, I suggested that the fault might be in the hyposulphite, or chloride of gold solutions, or particles of dust floating about in the room, and not in the plate.

A few days after he stated, that his plates having served him again in the same way, he procured a fresh supply of hyposulphite of soda and chloride of gold, but after applying them the result was no better. He then, by my advice, thoroughly cleaned his wash dishes, bottles and *water pail*, made fresh solutions and had no further trouble, becoming satisfied that the plates suffered an undue share of censure.

Sixth Process.—*Gilding the Picture.*—This is an improvement the honor of which is due to M. Figeau, and may take place either before the drying process, or at any subsequent period; but it improves the picture so materially that it should never be neglected. The articles necessary for gilding are—

A Pair of Plyars; *or a Gilding Stand and Chloride of Gold ;* or *Hyposulphite of Gold.*

The latter is imported by Mr. E. Anthony, 205 Broadway, New York, and is decidedly the best article for the purpose. One bottle simply dissolved in a quart of water will make a very strong solution, and gives a richness to the picture impossible to be obtained from the chloride of gold. The process is precisely similar to that described below for chloride of gold, taking care to *cease the moment* the *bubbles are well defined* over the surface of the plate. Many Daguerreotypists, after a superficial trial, discard the hyposulphite of gold as inferior ; but I have no hesitation in asserting that the fault lies with themselves ; for in every case within my knowledge,

where its use has been persisted in until the correct method has been ascertained, and the nature of the gilding has become familiar, it is always preferred. In illustration of this fact I will relate an anecdote:

A gentleman to whom it had been recommended, purchased a bottle, and after making one or two trials of it, wrote to his correspondent—"Send me two bottles of chloride of gold, for I want no more of the hyposulphite; it is good for nothing." A few weeks after he sent for three bottles of the condemned article, confessing that he had found fault unnecessarily; for, that since he had become familiar to its use, he must acknowledge its superiority, and would use no other gilding.

The Solution of Chloride of Gold is prepared by dissolving in a pint of distilled water, fifteen grains of chrystalized chloride of gold. This solution will be of a yellow tint. In another pint of distilled water dissolve fifty-five grains of hyposulphite of soda; pour gradually, in very small quantities, the gold into the hyposulphite of soda, stirring the solution at intervals; when finished the mixture should be nearly colorless.

Place the plate on its stand, or hold it in the plyers, in a perfectly horrizontal position—silver surface upward—having previously slightly turned up the edges, so that it may hold the solution. Wet the surface with alcohol, letting any superfluous quantity drain off. The alcohol is of no farther use than to facilitate the flowing of the gold mixture over the surface. Now pour on, carefully, as much of the preparation of gold as will remain on the plate. The under part of the plate is then to be heated as uniformly as possible with the spirit lamp; small bubbles will arise, and the appearance of the portrait or view very sensibly improved. The process must not be

carried too far, but as soon as the bubbles disappear the lamp should be removed, and the plate immersed in distilled water, and dried as before directed.

7th. Coloring the Picture.—I very much doubt the propriety of coloring the daguerreotypes, as I am of opinion, that they are little, if any, improved by the operation, at least as it is now generally practised.

There are several things requisite in an artist to enable him to color a head, or even a landscape effectively, and correctly, and I must say that very few of these are possessed by our operators as a class. These requirements are, a talent for drawing—taste—due discrimination of effect—strict observance of the characteristic points in the features of the subject—quick perception of the beautiful, and a knowledge of the art of mixing colors, and blending tints.

The method now pursued, I do not hesitate to say, and have no fears of being contradicted by those capable of critisizing, is on the whole ruinous to any daguerreotype, and to a perfect one absolutely disgusting. The day may come when accurate coloring may be obtained in the camera. Until that day, if we cannot lead taste into the right channel, we will endeavor to give such instructions that Daguerreotypists may proceed with this part of their work with a better understanding of the principles involved. For this purpose I have prepared a short chapter on the art of coloring, which may be found in the latter part of this volume.

To Preserve Daguerreotypes they must be well sealed and secured in a case, or frame. These, of course, are selected according to the taste of the customer, the principal requisite being good glass. Most Daguerreotypists prefer the white French plate glass—and many think,

very erroneously, that none is good unless it is thick—but the great desideratum is clearness and freedom from blisters; even glass a little tinged with green or yellow is to be preferred to the French plate when cloudy or blistered, and there is very little of it comes to this market that is not so. It is to be hoped that some of our glass factories will manage to manufacture an article expressly for daguerreotypes; and I would recommend them to do so, for they would find it quite an item of profit annually.

Before enclosing the picture in the case you should be careful to wipe the glass perfectly clean, and blow from the picture any particles of dust which may have fallen upon it. Then take strips of sticking paper, about half or three quarters of an inch wide, and firmly and neatly secure it to the glass, having first placed a "mat" between them to prevent the plate being scratched by the glass.

To make Sealing Paper.—Dissolve one ounce of gum arabic, and a quarter of an ounce of gum tragicanth in a pint of water; then add a teaspoonful of benzoin. Spread this evenly on one side of good stout tissue paper; let it dry, and then cut it up in stripes, about half or three quarters of an inch wide, for use. If it becomes too soft for summer use, add gum arabic; if too hard and cracking, add benzoin or gum tragicanth; if it gets too thick, add water.

Colored Daguerreotypes on Copper.—To effect this, take a polished plate of copper and expose it to the vapor of iodine, or bromine, or the two substances combined; or either of them in combination with chlorine. This gives a sensitive coating to the surface of the plate, which mav then be submitted to the action of light in the

camera. After remaining a sufficient time in the camera, the plate is taken out and exposed to the vapor of sulphuretted hydrogen. This vapor produces various colors on the plate, according to the intensity with which the light has acted on the different parts; consequently a colored photographic picture is obtained. No further process is necessary as exposure to light does not effect the picture.

By this process we have an advantage over the silvered plate, both in economy, and in the production of the picture in colors.

INSTANTANTANEOUS PICTURES BY MEANS OF GALVANISM.—It will be seen by the following valuable communication that galvanism can be successfully applied in producing pictures instantly; a process of great importance in securing the likeness of a child, or in taking views of animated nature. Colonel Whitney informs me that he once took a view of the steeple of the St. Louis Court House *after sundown* by this means, and also secured the image of a man in the act of stepping into a store, and before he had time to place his foot, raised for that purpose, on the door step. Mr. Whitney is well known as the talented editor of the Sunday Morning news.

New York, January 16, 1849.

Mr. H. H. SNELLING.

Dear Sir,—As you are about publishing a history of the Daguerreotype, and request a description of my mode of taking pictures instantaneously by the aid of galvanism, I comply with great pleasure.

In the year 1841, while practicing the art in St. Louis, Mo., I was at times, during the summer, much troubled with the electric influence of the atmosphere, especially

on the approach of a thunder-storm. At such times I found the coating of my plates much more sensitive than when the atmosphere was comparatively free from the electric fluid, and the effect was so irregular that no calculation could counteract the difficulty. This satisfied me that electricity was in some measure an important agent in the chemical process, and it occurred to me that the element might be turned to advantage. I determined, therefore, to enter on a series of experiments to test my theory. Finding it impossible to obtain an electric machine, and unwilling to abandon the examination, it occurred to me, that the galvanic influence might answer the same purpose. I therefore proceeded to make a galvanic battery in the following simple manner. I obtained a piece of zinc about two inches long, one inch wide, and an eighth of an inch thick. On this I soldered a narrow strip of copper, about six inches long, the soldered end laid on one side of the zinc, and extending its whole length. The battery was completed by placing the zinc in a glass tumbler, two-thirds full of dilute sulphuric acid, strong enough to produce a free action of the metals. The upper end of the copper slip extending above the tumbler was sharpened to a point, and bent a little over the glass.

The method of using, was thus :—After preparing the plate in the usual manner and placing it in the camera, in such manner as to expose the back of the plate to view, the battery was prepared by placing the zinc in the acid, and as soon as the galvanic fluid began to traverse (as could be known by the effervessence of the acid, operating on the zinc and copper) the cap of the camera was removed, and the plate exposed to the sitter ; at the same instant the point of the battery was brought quickly

against the back of the plate, and the cap replaced instantly. If the plate is exposed more than an instant after the contact, the picture will generally be found solarized. By this process I have taken pictures of persons in the act of walking, and in taking the pictures of infants and young children I found it very useful.

Very respectfully, yours,
Thomas R. Whitney.

Before we conclude this part of our subject, we must give a brief notice of a very remarkable invention of M. Martens, by which an extensive panoramic view, amounting even to an angle of 150°, may be taken by the Daguerreotype. The object-glass is fixed upon a pivot, and put in motion by an endless screw, so as to present a narrow aperture in front of it, in succession, to the landscape or group of figures to be copied. When the long iodized plate, curved cylindrically, is placed in the apparatus, the cover is taken from the object-glass, and the handle is turned slowly and steadily round; slowly when a dark object is in the field, and quickly when a luminous object is there. By means of a common achromatic object-glass, one inch and four-tenths in diameter, views have been produced thirty-eight centimetres long and twelve wide; and these views, one of which we have seen, are as perfect as if they had been taken by the common camera.

CHAP. VII.

PAPER DAGUERREOTYPES.—ETCHING DAGUERREOTYPES.

Mr. Hunt describes a process, discovered by himself by which the Daguerrean art may be applied to paper. His description is as follows:—

"Placing the paper on some hard body, wash it over on one side—by means of a very soft camel's hair pencil—with a solution of sixty grains of bromide of potassium, in two fluid ounces of distilled water, and then dry it quickly by the fire. Being dry, it is again washed over with the same solution, and dried as before. A solution of nitrate of silver—one hundred grains to an ounce of distilled water—is to be applied over the same surface, and the paper quickly dried in the dark. In this state the papers may be kept for use.

"When they are required, the above solution of silver is to be plentifully applied, and the paper placed wet in the camera, the greatest care being taken that no day light—not even the faintest gleam—falls upon it until the moment when you are prepared, by removing the dark slide, to permit the light, radiating from the object you wish to copy, to act in producing the picture. After a few seconds the light must be again shut off, and the camera removed into a dark room." The necessity of removing the camera is now avoided by the use of the dark slide, already described, covering the picture in the holder, which alone may be removed.—*Amer. Aut.*

" It will be found by taking the paper from the holder, that there is but a very faint outline—if any—yet visible. Place it aside, in perfect darkness until quite dry; then place it in the mercurial vapor box (meaning bath) and apply a very gentle heat to the bottom. The moment the mercury vaporizes, the picture will begin to develope itself. The spirit lamp must now be removed for a short time, and when the action of the mercury appears to cease, it is to be very carefully applied again, until a well defined picture is visible. The vaporization must then be suddenly stopped, and the photograph removed from the box. The drawing will then be very beautiful and distinct; but much detail is still clouded, for the developement of which it is only necessary to place it in the dark and suffer it to remain undisturbed for some hours. There is now an inexpressible charm about the pictures, equaling the delicate beauty of the daguerreotype; but being very susceptible of change, it must be viewed by the light of a taper only. The nitrate of silver must now be removed from the paper, by well washing it in soft water, to which a small quantity ef salt has been added, and it should afterwards be soaked in water only. When the picture has been dried, wash it quickly over with a soft brush dipped in a warm solution of hyposulphite of soda, and then wash it for some time in distilled water, in order that all the hyposulphite may be removed. The drawing is now fixed and we may use it to procure positive copies, (the original being termed a negative,) many of which may be taken from one original."

" The action of light on this preparation, does indeed appear to be instantaneous. The exquisite delicacy of this preparation may be imagined, when I state that in

five seconds in the camera, I have, during sunshine, obtained perfect pictures, and that when the sky is overcast, *one minute* is quite sufficient to produce a most decided effect."

"This very beautiful process is not without its difficulties; and the author cannot promise that, even with the closest attention to the above directions, annoying failures will not occur. It often happens that some accidental circumstance—generally a projecting film or a little dust—will occasion the mercurial vapor to act with great energy on one part of the paper, and blacken it before the other portions are at all effected. Again, the mercury will sometimes accumulate along the lines made by the brush, and give a streaky appearance to the picture, although these lines are not at all evident before the mercurial vapor was applied. (A brush sufficiently large —and they may be easily obtained—will, in a measure, prevent this difficulty.—*Amer Au.*) I have stated that the paper should be placed wet in the camera; the same paper may be used dry, which often is a great convenience. When in the dry state a little longer exposure is required; and instead of taking a picture in four or five seconds, two or three minutes are necessary."

The durability of daguerreotypes has been, and is still, doubted by many, but experiment has proved that they are more permanent than oil paintings or engravings.

Etching Daguerreotypes.—There are several methods of accomplishing this object; discovered and applied by different individuals.

The first process was published at Vienna by Dr. Berres, and consisted in covering the plate with the mucilage of gum arabic, and then immersing the plate in nitric acid of different strengths.

Mr. Figeau, of whom I have already spoken, likewise discovered a process for the engraving of Daguerreotypes; and founded on the belief that the lights of a Daguerreotype plate consists of unaltered silver, while the dark or shadows consists of mercury or an amalgam of mercury with silver. He finds that a compound acid, consisting of a mixture of nitric, nitrous, and muriatic acids, or of nitric mixed with nitrate of potass and common salt, has the property of attacking the silver in presence of the mercury without acting upon the latter. Bi-chloride of copper answers the purpose also, but less completely.

"When the clean surface of a Daguerreotype plate is exposed to the action of this menstruum, particularly if warm, the white parts, or lights are not altered, but the dark parts are attacked, and chloride of silver is formed, of which an insoluable coating is soon deposited, and the action of the acid soon ceases. This coat of chloride of silver is removed by a solution of ammonia, and then the acid applied again, and so on, until the depth of *biting in* is sufficient. However, it is not possible, by repeating this process, to get a sufficient force of impression; a second operation is required, in order to obtain such a depth as will hold the ink, to give a dark impression; for this purpose the whole plate is covered with drying oil; this is cleared off with the hand, exactly in the way a copper plate printer cleans his plate. The oil is thus left in the *sinkings*, or dark *bitten in* parts only. The whole plate is now placed in a suitable apparatus, and the lights or prominent parts of the face are gilt by the electrotype process. The whole surface is now touched with what the French engravers call the "Resin Grain," (*grain de resine*), a species of partial stopping

out, and it is at once bitten in to a sufficient depth with nitric acid, the gilding preserving the lights from all action of the acid. The resin grain gives a surface to the corroded parts suitable for holding the ink, and the plate is now finished and fit to give impressions resembling aquatint. But as silver is so soft a metal that the surface of the plate might be expected to wear rapidly, the discoverer proposes to shield it by depositing over its whole surface a very thin coat of copper by the electrotype process; which when worn may be removed at pleasure down to the surface of the noble metal beneath, and again a fresh coat of copper deposited; and so an unlimited number of impressions obtained without injuring the plate itself."

If, as has been asserted, steel may be rendered sufficiently sensitive, to take photographic impressions, to what a revolution will the art of engraving be subject by the discovery of this process.

CHAP. VIII.

PHOTOGENIC DRAWING ON PAPER.

We shall now proceed to describe the various processes for Photogenic drawing on paper; first, however, impressing on the mind of the experimenter, the necessity which exists for extreme care in every stage of the manipulation. In this portion of my work I am entirely indebted to the works of Professors Hunt, Fisher and others.

I. Apparatus and Materials.—*Paper.*—The principal difficulty to be contended with in using paper, is the different power of imbibition which we often find possessed in the same sheet, owing to trifling inequalities in its texture. This is, to a certain extent, to be overcome by a careful examination of each sheet, by the light of a candle or lamp at night, or in the dark. By extending each sheet between the light and the eye, and slowly moving it up and down, and from left to right, the variations in its texture will be seen by the different quantities of light which pass through it in different parts; and it is always the safest course to reject every sheet in which inequalities exist. Paper sometimes contains minute portions of thread, black or brown specks, and other imperfections, all of which materially interfere with the process. Some paper has an artificial substance given to it by sulphate of lime (Plaster of Paris); this defect only exists, however, in the cheaper sorts of demy, and therefore can be easily avoided. In all cases such paper

should be rejected, as no really sensitive material can be obtained with it. Paper-makers, as is well known, often affix their name to one half the sheet; this moiety should also be placed aside, as the letters must frequently come out with annoying distinctness. Well sized paper is by no means objectionable, indeed, is rather to be preferred, since the size tends to exalt the sensitive powers of the silver. The principal thing to be avoided, is the absorption of the sensitive solution into the pores; and it must be evident that this desideratum cannot be obtained by unsized paper. Taking all things into consideration, the paper known as *satin post* would appear to be preferable, although the precautions already recommended should be taken in its selection.

Brushes.—The necessary solutions are to be laid upon the paper by brushes. Some persons pass the paper over the surface of the solutions, thus licking up, as it were, a portion of the fluid; but this method is apt to give an uneven surface; it also rapidly spoils the solutions. At all events, the brush is the most ready and the most effectual means.

Distilled Water.—All the water used, both for mixing the solutions, washing the paper, or cleaning the brushes, must be distilled, to obtain good results, for reasons before specified.

Blotting Paper.—In many instances, the prepared paper requires to be lightly dried with bibulous paper. The best description is the white sort. In each stage of the preparation distinct portions of bibulous paper must be used. If these be kept seperate and marked, they can be again employed for the same stage; but it would not do, for example, to dry the finished picture in the same folds in which the sensitive paper had been pressed. A

very convenient method is to have two or three quarto size books of bibulous paper, one for each seperate process.

Nitrate of Silver.—In the practice of the photographic art, much depends on the nitrate of silver. Care should be taken to procure the best; the crystalized salt is most suitable for the purpose While in the form of crystal it is not injured by exposure to light, but the bottles containing the solutions of this salt should at all times be kept wrapped in dark paper, and excluded from daylight.

II. Different Methods of Preparing the Paper.—*Preparation of the Paper.*—Dip the paper to be prepared into a weak solution of common salt. The solution should not be saturated, but six or eight times diluted with water. When perfectly moistened, wipe it dry with a towel, or press it between bibulous paper, by which operation the salt is uniformly dispersed through its substance. Then brush over it, on one side only, a solution of nitrate of silver. The strength of this solution must vary according to the color and sensitiveness required. Mr. Talbot recommends about fifty grains of the salt to an ounce of distilled water. Some advise twenty grains only, while others say eighty grains to the ounce. When dried in a dark room, the paper is fit for use. To render this paper still more sensitive, it must again be washed with salt and water, and afterwards with the same solution of nitrate of silver, drying it between times. This paper, if carefully made, is very useful for all ordinary photographic purposes. For example, nothing can be more perfect than the images it gives of leaves and flowers, especially with a summer's sun; the light, passing through the leaves, delineates every ramification of

their fibres. In conducting this operation, however, it will be found that the results are sometimes more and sometimes less satisfactory, in consequence of small and accidental variations in the proportions employed. It happens sometimes that the chloride of silver formed on the surface of the paper is disposed to blacken of itself, without any exposure to light. This shows that the attempt to give it sensibility has been carried too far. The object is, to approach as nearly to this condition as possible without reaching it; so that the preparation may be in a state ready to yield to the slightest extraneous force, such as the feeblest effect of light.

Cooper's Method.—Soak the paper in a boiling hot solution of chlorate of potash (the strength matters not) for a few minutes; then take it out, dry it, and wet it with a brush, on one side only, dipped in a solution of nitrate of silver, sixty grains to an ounce of distilled water, or, if not required to be so sensitive, thirty grains to the ounce will do. This paper possesses a great advantage over any other, for the image can be fixed by mere washing. It is, however, very apt to become discolored even in the washing, or shortly afterwards, and is, besides, not so sensitive, nor does it become so dark as that made according to Mr. Talbot's method.

Daguerre's Method.—Immerse the paper in hydrochloric (or as it is more commonly called, muriatic) ether, which has been kept sufficiently long to become acid; the paper is then carefully and completely dried, as this is essential to its proper preparation. It is then dipped into a solution of nitrate of silver, and dried without artificial heat in a room from which every ray of light is carefully excluded. By this process it acquires a very remarkable facility in being blackened on a very slight ex-

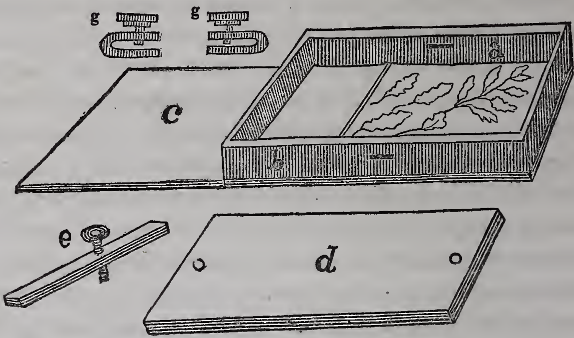
posure to light, even when the latter is by no means intense. The paper, however, rapidly loses its extreme sensitiveness to light, and finally becomes no more impressionable by the solar beams than common nitrate paper.

Bromide Paper.—Of all common photographic paper, the best, because the least troublesome in making, and the most satisfactory in result, is that which is termed bromine paper, and which is thus prepared :—Dissolve one hundred grains of bromide of potassium in one ounce of distilled water, and soak the paper in this solution. Take off the superfluous moisture, by means of your bibulous paper, and when nearly dry, brush it over on one side only, with a solution of one hundred grains of nitrate of silver to an ounce of distilled water. The paper should then be dried in a dark room, and, if required to be very sensitive, should a second time be brushed over with the nitrate of silver solution.

In preparing the papers mentioned above, there are two circumstances which require particular attention. In the first place, it is necessary to mark the paper on the side spread with the solutions of nitrate of silver, near one of the extreme corners. This answers two purposes : in the first place it serves to inform the experimentalist of the sensitive surface ; and secondly, it will be a guide as to which portion of the papers has been handled during the application of the solution, as the impress of the fingers will probably come out upon the photograph. The second caution is, that the application of the sensitive solution (nitrate of silver,) and the subsequent drying of the paper, must be always conducted in a perfectly dark room, the light of a candle alone being used.

III. Photogenic Process on paper.—*Method.*— The simplest mode is to procure a flat board and a square of glass, larger in size than the object intended to be copied. On the board place the photogra-

Fig. 28.



phic paper with the prepared side upwards, and upon it the object to be copied; over both lay the glass and secure them so that they are in close connection by means of binding screws or clamps, similar to g. g. fig. 28. Should the object to be copied be of unequal thickness, such as a leaf, grass, &c., it will be necessary to place on the board, first, a soft cushion, which may be made of a piece of fine flannel and cotton wool. By this means the object is brought into closer contact with the paper, which is of great consequence, and adds materially to the clearness of the copy. The paper is now exposed to diffused daylight, or, still better, to the direct rays of the sun, when that part of the paper not covered by the object will become tinged with a violet color, and if the paper be well prepared, it will in a short time pass to a deep brown or bronze color. It must then be removed, as no advantage will be obtained

by keeping it longer exposed; on the contrary, the delicate parts yet uncolored will become in some degree affected. The photogenic paper will now show a more or less white and distinct representation of the object. The apparatus figured at 28 consists of a wooden frame similar to a picture frame; a piece of plate glass is fixed in front; and it is provided with a sliding cover of wood, *c.*, which is removed when the paper is ready to be exposed to the action of the light. The back, *d.*, which is furnished with a cushion, as just described, is made to remove for the purpose of introducing the object to be copied, and upon it the prepared paper; the back is then replaced, and, by aid of the cross piece and screw, *e.*, the whole is brought into close contact with the glass.

The objects best delineated on these photographic papers, are lace, feathers, dried plants, particularly the ferns, sea-weeds and the light grasses, impressions of copper plate and wood engravings, particularly if they have considerable contrast of light and shade—(these should be placed with the face downwards, having been previously prepared as hereafter directed)—paintings on glass, etchings, &c.

To fix the Drawings.—Mr. Talbot recommends that the drawings should be dipped in salt and water, and in many instances this method will succeed, but at times it is equally unsuccessful. Iodide of potassium, or, as it is frequently called, hydriodate of potash, dissolved in water, and very much diluted, (twenty-five grains to one ounce of water,) is a more useful preparation to wash the drawings with; it must be used very weak or it will not dissolve the unchanged muriate only, as is intended, but the black oxide also, and the drawing be thereby spoiled.

But the most certain material to be used is the hyposulphite of soda. One ounce of this salt should be dissolved in about a pint of distilled water. Having previously washed the drawing in a little lukewarm water, which of itself removes a large portion of the muriate of silver which is to be got rid of, it should be dipped once or twice in the hyposulphite solution. By this operation the muriate which lies upon the lighter parts will become so altered in its nature as to be unchanged by light, while the rest remains dark as before.

It will be evident from the nature of the process, that the lights and shadows of an object are reversed. That which is originally opaque will intercept the light, and consequently those parts of the photogenic paper will be least influenced by light, while any part of the object which is transparent, by admitting the light through it, will suffer the effect to be greater or less in exact proportion to its degree of transparency. The object wholly intercepting the light will show a white impression ; in selecting, for example, a butterfly for an object, the insect, being more or less transparent, leaves a proportionate gradation of light and shade, the most opaque parts showing the whitest. It may be said, therefore, that this is not natural, and in order to obtain a true picture—or, as it is termed, a positive picture—we must place our first acquired photograph upon a second piece of photogenic paper. Before we do this, however, we must render our photograph transparent, otherwise the opacity of the paper will mar our efforts.

To accomplish this object, the back of the paper containing the *negative*, or first acquired photograph, should be covered with white or virgin wax. This may be done by scraping the wax upon the paper, and then, after

placing it between two other pieces of paper, passing a heated iron over it. The picture, being thus rendered transparent, should now be applied to a second piece of photogenic paper, and exposed, in the manner before directed, either to diffused day-light or to the direct rays of the sun. The light will now penetrate the white parts, and the second photograph be the reverse of the first, or a true picture of the original.

Instead of wax, boiled linseed oil—it must be the best and most transparent kind—may be used. The back of the negative photograph should be smeared with the oil, and then placed between sheets of bibulous paper. When dry the paper is highly transparent.

IV. Application of Photogenic Drawing.—This method of photogenic drawing may be applied to many useful purposes, such as the copying of paintings on glass by the light thrown through them on the prepared paper—Imitations of etchings, which may be accomplished by covering a piece of glass with a thick coat of white oil paint; when dry, with the point of a needle, lines or scratches are to be made through the white lead ground, so as to lay the glass bare; then place the glass upon a piece of prepared paper, and expose it to the light. Of course every line will be represented beneath of a black color, and thus an imitation etching will be produced. It is also applicable to the delineation of microscopic objects, architecture, sculpture, landscapes and external nature.

A novel application of this art has been recently suggested, which would doubtless prove useful in very many instances. By rendering the wood used for engravings sensitive to light, impressions may be at once made thereon, without the aid of the artist's pencil. The pre-

paration of the wood is simply as follows:—Place its face or smooth side downwards, in a plate containing twenty grains of common salt dissolved in an ounce of water; here let it remain for five minutes, take it out and dry it; then place it again face downwards in another plate containing sixty grains of nitrate of silver to an ounce of water; here let it rest one minute, when taken out and dried in the dark it will be fit for use, and will become, on exposure to the light, of a fine brown color. Should it be required more sensitive, it must be immersed in each solution a second time, for a few seconds only. It will now be very soon effected by a very diffused light.

This process may be useful to carvers and wood engravers; not only to those who cut the fine objects of artistical design, but still more to those who cut patterns and blocks for lace, muslin, calico-printing, paper hangings, etc., as by this means the errors, expense and time of the draughtsman may be wholly saved, and in a minute or two the most elaborate picture or design, or the most complicated machinery, be delineated with the utmost truth and clearness.

CHAP. IX.

CALOTYPE AND CHRYSOTYPE.

The materials and apparatus necessary for the Calotype process are—

Two or Three Shallow Dishes, for holding distilled water, iodide, potassium, &c.—the same water never being used for two different operations.

White Bibulous Paper.

Photogenic Camera—Fig. 9.

Pressure Frame—Fig 28.

Paper, of the very best quality—directions for the choice of which have been already given.

A Screen of Yellow Glass.

Camels' or Badgers' hair Brushes:—A seperate one being kept for each wash and solution, and which should be thoroughly cleansed immediately after using in distilled water. That used for the gallo-nitrate is soon destroyed, owing to the rapid decomposition of that preparation.

A Graduated Measure.

Three or Four Flat Boards, to which the paper may be fixed with drawing pins.

A Hot Water Drying Apparatus, for drying the paper will also be found useful.

In preparing the Calotype paper, it is necessary to be extremely careful, not only to prevent the daylight from

impringing upon it, but also to exclude, if possible, the strong glare of the candle or lamp. This may be effected by using a shade of yellow glass or gauze, which must be placed around the light. Light passing through such a medium will scarcely affect the sensitive compounds, the yellow glass intercepting the chemical rays.

Preparation of the Iodized Paper.—Dissolve one hundred grains of crystalized nitrate of silver in six ounces of distilled water, and having fixed the paper to one of the boards, brush it over with a soft brush on one side only with this solution, a mark being placed on that side whereby it may be known. When nearly dry dip it into a solution of iodide of potassium, containing five hundred grains of that salt dissolved in a pint of water. When perfectly saturated with this solution, it should be washed in distilled water, drained and allowed to dry. This is the first part of the process, and the paper so prepared is called *iodized paper*. It should be kept in a port-folio or drawer until required: with this care it may be preserved for any length of time without spoiling or undergoing any change.

Mr. Cundell finds a stronger solution of nitrate of silver preferable, and employs thirty grains to the ounce of distilled water: he also adds fifty grains of common salt to the iodide of potassium, which he applies to the marked side of the paper only. This is the first process.

Preparation of the paper for the Camera.—The second process consists in applying to the above a solution which has been named by Mr. Talbot the "Gallo-Nitrate of Silver;" it is prepared in the following manner: Dissolve one hundred grains of crystalized nitrate of silver in two ounces of distilled water, to which is added two

and two-third drachms of strong acetic acid. This solution should be kept in a bottle carefully excluded from the light. Now, make a solution of gallic acid in cold distilled water: the quantity dissolved is very small. When it is required to take a picture, the two liquids above described should be mixed together in equal quantities; but as it speedily undergoes decomposition, and will not keep good for many minutes, only just sufficient for the time should be prepared, and that used without delay. It is also well not to make much of the gallic acid solution, as it will not keep for more than a few days without spoiling. A sheet of the iodized paper should be washed over with a brush with this mixed solution, care being taken that it be applied to the marked side. This operation must be performed by candle light. Let the paper rest half a minute, then dip it into one of the dishes of water, passing it beneath the surface several times; it is now allowed to drain, and dried by placing its marked side upward, on the drying apparatus. It is better not to touch the surface with bibulous paper. It is now highly sensitive, and ready to receive the impression. In practice it is found better and more economical not to mix the nitrate of silver and gallic acid, but only to brush the paper with the solution of the nitrate.

Mr. Talbot has recently proposed some modifications in his method of preparing the calotype paper. The paper is first iodized in the usual way; it is then washed over with a saturated solution of gallic acid in distilled water and dried. Thus prepared he calls it the io-gallic paper: it will remain good for a considerable time if kept in a press or portfolio. When required for use, it is washed with a solution of nitrate of silver (fifty grains to the

ounce of distilled water), and it is then fit for the camera.

Exposure in the Camera.—The calotype paper thus prepared possesses a very high degree of sensibility when exposed to light, and we are thus provided with a medium by which, with the aid of the photogenic camera, we may effectually copy views from nature, figures, buildings, and even take portraits from the shadows thrown on the paper by the living face. The paper may be used somewhat damp. The best plan for fixing it in the camera is to place it between a piece of plate glass and some other material with a flat surface, as a piece of smooth slate or an iron plate, which latter, if made warm, renders the paper more sensitive, and consequently the picture is obtained more rapidly.

Time of Exposure.—With regard to the time which should be allowed for the paper to remain in the camera, no direct rules can be laid down; this will depend altogether upon the nature of the object to be copied, and the light which prevails. All that can be said is, that the time necessary for forming a good picture varies from thirty seconds to five minutes, and it will be naturally the first object of the operator to gain by experience this important knowledge.

Bringing Out the Picture.—The paper when taken from the camera, which should be done so as to exclude every ray of light—and here the dark slide of the camera plate holder becomes of great use—bears no resemblance to the picture which in reality is formed. The impression is latent and invisible, and its existence would not be suspected by any one not acquainted with the process by previous experiment. The method of bringing out the image is very simple. It consists in wash-

ing the paper with the *gallo-nitrate of silver*, prepared in the way already described, and then warming it gently, being careful at the same time not to let any portion become perfectly dry. In a few seconds the part of the paper upon which the light has acted will begin to darken, and finally grow entirely black, while the other parts retain their original color. Even a weak impression may be brought out by again washing the paper in the gallo-nitrate, and once more gently warming it. When the paper is quite black, as is generally the case, it is a highly curious and beautiful phenomenon to witness the commencement of the picture, first tracing out the stronger outlines, and then gradually filling up all the numerous and complicated details. The artist should watch the picture as it developes itself, and when in his judgment it has attained the greatest degree of strength and clearness, he shall stop further proceedings by washing it with the fixing liquid. Here again the mixed solution need not be used, but the picture simply brushed over with the gallic acid.

The Fixing Process.—In order to fix the picture thus obtained, first dip it into water; then partly dry it with bibulous paper, and wash it with a solution of bromide of potassium—containing one hundred grains of that salt dissolved in eight or ten ounces of distilled water. The picture is again washed with distilled water, and then finally dried. Instead of bromide of potassium, a solution of hyposulphite of soda, as before directed, may be used with equal advantage.

The original calotype picture, like the photographic one described in the last chapter, is negative, that is to say, it has its lights and shades reversed, giving the whole an appearance not conformable to nature. But it

is easy from this picture to obtain another which shall be conformable to nature; viz., in which the lights shall be represented by lights, and the shades by shades. It is only necessary to take a sheet of photographic paper (the bromide paper is the best), and place it in contact with a calotype picture previously rendered transparent by wax or oil as before directed. Fix it in the frame, *Fig.* 28, expose it in the sunshine for a short time, and an image or copy will be formed on the photogenic paper. The calotype paper itself may be used to take the second, or positive, picture, but this Mr. Talbot does not recommend, for although it takes a much longer time to take a copy on the photogenic paper, yet the tints of such copy are generally more harmonious and agreeable. After a calotype picture has furnished a number of copies it sometimes grows faint, and the subsequent copies are inferior. This may be prevented by means of a process which revives the strength of the calotype pictures. In order to do this, it is only nesessary to wash them by candle-light with gallo-nitrate of silver, and then warm them. This causes all the shades of the picture to darken considerably, while the white parts are unaffected. After this the picture is of course to be fixed a second time. It will then yield a second series of copies, and, in this way, a great number may frequently be made.

The calotype pictures when prepared as we have stated, possess a yellowish tint, which impedes the process of taking copies from them. In order to remedy this defect, Mr. Talbot has devised the following method. The calotype picture is plunged into a solution consisting of hyposulphite of soda dissolved in about ten times its weight of water, and heated nearly to the boiling point. The picture should remain in about ten minutes; it must then

be removed, washed and dried. By this process the picture is rendered more transparent, and its lights become whiter. It is also rendered exceedingly permanent After this process the picture may be waxed, and thus its transparency increased. This process is applicable to all photographic papers prepared with solutions of silver.

Having thus fully, and it is hoped clearly, considered the process, it may be necessary before dismissing the calotype from notice, to add one or two remarks from the observations and labors of some who have experimented in this art. Dr. Ryan in his lectures before the Royal Polytechnic Institution, has observed, that in the iodizing process the sensitiveness of the paper is materially injured by keeping it too long in the solution of iodide of potassium, owing to the newly formed iodide of silver being so exceedingly solvable in excess of iodide of potassium as in a few minutes to be completely removed. The paper should be dipped in the solution and instantly removed. There is another point, too, in the preparation of the iodized paper in which suggestions for a slight deviation from Mr. Talbot's plan have been made. In the first instance, it is recommended that the paper be brushed over with the iodide of potassium, instead of the nitrate of silver, transposing, in fact, the application of the first two solutions. The paper, having been brushed over with the iodide of potassium in solution, is washed in distilled water and dried. It is then brushed over with nitrate of silver, and after drying is dipped for a moment in a fresh solution of iodide of potassium of only one-fourth the strength of the first, that is to say, one hundred and twenty-five grains of the salt to a pint of water. After this it is again washed and dried. The advantage derived from this method, is a more sensitive paper, and

a more even distribution of the compounds over the surface.

Another deviation from Mr. Talbot's method has been suggested, as follows:

Brush the paper over with a solution of one hundred grains of nitrate of silver to an ounce of water. When nearly, but not quite, dry, dip it into a solution of twenty-five grains of iodide of potassium to one ounce of distilled water, drain it, wash it in distilled water and again drain it. Now brush it over with aceto-nitrate of silver, made by dissolving fifty grains of nitrate of silver in one ounce of distilled water, to which is added one sixth of its volume of strong acetic acid. Dry it with bibulous paper, and it is ready for receiving the image. When the impression has been received, which will require from one to five minutes according to the state of the weather, it must be washed with a saturated solution of gallic acid to which a few drops of the aceto-nitrate of silver, made as above, have been added. The image will thus be gradually brought out, and may be fixed with hyposulphite of soda. To obtain the positive picture, paper must be used brushed over with an ammonio-nitrate of silver, made thus: forty grains of nitrate of silver is to be dissolved in one ounce of distilled water, and liquid ammonia cautiously added till it re-dissolves the precipitate.

A pleasing effect may be given to calotype, or indeed to all photographic pictures, by waxing them at the back, and mounting them on white paper, or if colored paper be used, various beautiful tones of color are produced

POSITIVE CALOTYPE.

At a meeting of the British Association, Professor Grove described a process by which positive calotyp

pictures could be directly obtained; and thus the necessity to transfer by which the imperfections of the paper are shown, and which is moreover a troublesome and tedious process, is avoided. As light favors most chemical actions, Mr. Grove was led to believe that a paper darkened by the sun (which darkening is supposed to result from the precipitation of silver) might be bleached by using a solvent which would not attack the silver in the dark, but would do so in the light. The plan found to be the most successful is as follows: ordinary calotype paper is darkened till it assumes a deep brown color, almost amounting to black; it is then redipped into the ordinary solution of iodide of potassium, and dried. When required for use it is drawn over dilute nitric acid—one part acid to two and a half parts water. In this state, those parts exposed to the light are rapidly bleached, while the parts not exposed remain unchanged. It is fixed by washing in water, and subsequently in hyposulphite of soda, or bromide of potassium.

Mr. Grove also describes a process for converting a negative calotype into a positive one, which promises, when carried out, to be of great utility.

Let an ordinary calotype image or portrait be taken in the camera, and developed by gallic acid; then drawn over iodide of potassium and dilute nitric acid and exposed to full sunshine; while bleaching the dark parts, the light is redarkening the newly precipitated iodide in the lighter portions and thus the negative picture is converted into a positive one.

The calotype process has been applied to the art of printing, in England, but it possesses no advantages whatever over the method, with type, now so gloriously brought to perfection; and I can hardly think it will

ever be made of any utility. For the benefit of the curious, however, I will give Mr. Talbot's method.

Some pages of letter-press are taken printed on one side only; and waxed, to render them more transparent; the letters are then cut out and sorted. To compose a new page lines are ruled on a sheet of white paper, and the words are formed by fixing the seperate letters in their proper order. The page being ready, a negative photograph is produced from it, from which the requisite number of positive photogenic copies may be obtained.

Another method, which requires the use of the camera, consists in employing large letters painted on rectangular pieces of wood, colored white. These are arranged in lines on a tablet or board, by slipping them into grooves which keep them steady and upright, thus forming a page on an enlarged scale. It is now placed before a camera, and a reduced image of it of the required size is thrown upon the sensitive paper. The adjustments must be kept invariable, so that the consecutive pages may not vary from one another in the size of the type. Mr. Talbot has patented his process, but what benefit he expects to derive from it, I am at a loss to determine.

Enlarged copies of calotype or Daguerreotype portraits may be obtained by throwing magnified images of them, by means of lenses, upon calotype paper.

THE CHRYSOTYPE.

A modification of Mr. Talbot's process, to which the name of Chrysotype was given by its discoverer, Sir John Herschel, was communicated in June 1843 to the Royal Society, by that distinguished philosopher. This modification would appear to unite the simplicity of photography with all the distinctness and clearness of calotype. This preparation is as follows.

The paper is to be washed in a solution of ammonio-citrate of iron; it must then be dried, and subsequently brushed over with a solution of the ferro-sesquicyanuret of potassium. This paper, when dried in a perfectly dark room, is ready for use in the same manner as if otherwise prepared, the image being subsequently brought out by any neutral solution of gold. Such was the first declaration of his discovery, but he has since found that a neutral solution of silver is equally useful in bringing out the picture. Photographic pictures taken on this paper are distinguished by a clearness of outline foreign to all other methods.

PICTURES ON GLASS.

Messrs. Langenheim, of Philadelphia, having made some noise in regard to the taking of photographic pictures on glass, and claiming the exclusive use by right of invention, I deem it proper to give the method of M. Evrard, of Lille, France, which, not being patented in this country, is free to all. M. Evrard's process is as follows:

"The principle of the discovery is a matrix of albumen, rendered sensible to the action of light by aceto-nitrate of silver, and spread in a thin layer on a plate of glass.—The process is to take a certain number of the white of eggs, and remove all the non-transparent part, and then add a few drops of a saturated solution of iodate of potassium; then beat the eggs into froth, and allow it to settle. The plate of glass is well cleaned with alcohol, and the albumen is then spread over the glass in a thin layer with another piece of glass. The glass must have a perfect thin coat adhering to it, when it is hung up by one of the corners to drain off the excess. The glass is then placed flat upon a level board, screened from dust, and allowed to

dry. When dry, it is submitted to a good heat, but not so much that the albumen will peel of. After this, the glass is dipped into a solution of aceto-nitrate of silver, face downwards, after which it is removed and immersed in a basin of clean water, being stirred in it for a few seconds, then taken out, held up by a corner, and is completely sensitive, moist or dry, to receive photographic impressions. It is then placed in the camera obscura, after which it is dipped in a bath of galic acid, to which is added a little of aceto-nitrate of silver. Care is taken not to let the glass remain too long in this. After being dipped in the galic acid, it is washed in water, and then immersed in a solution of the bromide of potassium, (20 parts to 100 of water,) after which it is carefully and well washed in water, and left to dry in a horizontal position in a dark room.

CHAP. X.

CYANOTYPE--ENERGIATYPE—CHROMATYPE—ANTHOTYPE—AMPHITYPE AND "CRAYON DAGUERREOTYPE."

THE several processes enumerated at the head of this chapter, are all discoveries of English philosophers, with the exception of the third and last named. Anthotype was first attempted by M. Ponton a French savan, although it was reserved to Mr. Hunt to bring the process to its present state. The "Crayon Daguerreotype" is an improvement made by J. A Whipple, Esq., of Boston

I. CYANOTYPE;

So called from the circumstance of cyanogen in its combinations with iron performing a leading part in the process. It was discovered by Sir John Herschel. The process is a simple one, and the resulting pictures are blue.

Brush the paper over with a solution of the ammonio-citrate of iron. This solution should be sufficiently strong to resemble sherry wine in color. Expose the paper in the usual way, and pass over it very sparingly and evenly a wash of the common yellow ferro-cyanate of potass. As soon as the liquid is applied, the negative picture vanishes, and is replaced by a positive one, of a violet blue color, on a greenish yellow ground, which at a certain time possesses a high degree of sharpness, and singular beauty of tint.

A curious process was discovered by Sir John Herschel, by which dormant pictures are produced capable of developement by the breath, or by keeping in a moist atmosphere. It is as follows.

If nitrate of silver, specific gravity 1.200 be added to ferro-tartaric acid, specific gravity 1.023, a precipitate falls, which is in a great measure redissolved by a gentle heat, leaving a black sediment, which, being cleared by subsidence, a liquid of a pale yellow color is obtained, in which the further addition of the nitrate causes no turbidness. When the total quantity of the nitrated solution added amounts to about half the bulk of the ferro-tartaric acid, it is enough. The liquid so prepared does not alter if kept in the dark. Spread on paper, and exposed *wet* to the sunshine (partly shaded) for a few seconds, no impression seems to be made, but by degrees, although withdrawn from the action of light, it developes itself spontaneously, and at length becomes very intense. But if the paper be thoroughly dried in the dark, (in which state it is of a very pale greenish yellow color,) it possesses the singular property of receiving a dormant or invisible picture, to produce which from thirty to sixty seconds' exposure to sunshine is requisite. It should not be exposed too long, as not only is the ultimate effect less striking, but a picture begins to be *visibly* produced, which darkens spontaneously after it is withdrawn. But if the exposure be discontinued before this effect comes on, an invisible impression is the result, to develope which all that is necessary is to breathe upon it, when it immediately appears, and very speedily acquires an extraordinary intensity and sharpness, as if by magic. Instead of the breath, it may be subject to the regular action of aqueous vapor, by laying it in a blotting paper book, of

which some of the outer leaves on both sides have been dampened, or by holding over warm water.

II. ENERGIATYPE.

Under this title a process has been brought forward by Mr. Hunt. It consists of the application of a solution of succinic acid to paper, which is subsequently washed over with nitrate of silver. The image is then to be taken either in the camera or otherwise, as required, and is brought out by the application of the sulphate of iron in solution. Although this process has not come into general use, its exact description may be interesting to the general reader, and we therefore subjoin it.

The solution with which the paper is first washed is to be prepared as follows: succinic acid, two drachms; common salt, five grains; mucilage of gum arabic, half a fluid drachm; distilled water, one fluid drachm and a half. When the paper is nearly dry, it is to be brushed over with a solution of nitrate of silver, containing a drachm of the salt, to an ounce of distilled water. It is now ready for exposure in the camera. To bring out the dormant picture it is necessary to wash it with a mixture of a drachm of concentrated solution of the green sulphate of iron and two drachms and a half of mucilage of gum arabic.

Subsequently, however, it has been found that the sulphate of iron produces upon all the salts of silver effects quite as beautiful as in the succinate. On the iodide, bromide, acetate, and benzoate, the effects are far more pleasing and striking. When pictures are produced, or the dormant camera image brought out, by the agency of sulphate of iron, it is remarkable how rapidly the effect takes place. Engravings can be thus copied almost instantaneously, and camera views obtained in one

or two minutes on almost any preparation of silver. The common sulphate of copper solution has the same property.

III. CHROMATYPE.

Many efforts have been made to render chromatic acid an active agent in the production of photographs. M. Ponton used a paper saturated with bichromate of potash, and this was one of the earliest photogenic processes. M. Becquerel improved upon this process by sizing the paper with starch previous to the application of the bichromate of potash solution, which enabled him to convert the negative picture into a positive one, by the use of a solution of iodine, which combined with that portion of the starch on which the light had not acted. But by neither of these processes could clear and distinct pictures be formed. Mr. Hunt has, however, discovered a process which is so exceedingly simple, and the resulting pictures of so pleasing a character, that, although it is not sufficiently sensitive for use in the camera, it will be found of the greatest value for copying botanical specimens, engravings, or the like.

The paper to be prepared is washed over with a solution of sulphate of copper—about one drachm to an ounce of water—and partially dried; it is then washed with a moderately strong solution of bichromate of potash, and dried at a little distance from the fire. Paper thus prepared may be kept any length of time, in a portfolio, and are always ready for use.

When exposed to the sunshine for a time, varying with the intensity of the light, from five to fifteen or twenty minutes, the result is generally a negative picture. It is now to be washed over with a solution of nitrate of silver, which immediately produces a very beau-

tiful deep orange picture upon a light dim colored, or sometimes perfectly white ground. This picture must be quickly fixed, by being washed in pure water, and dried. With regard to the strength of the solutions, it is a remarkable fact, that, if saturated solutions be employed, a negative picture is first produced, but if the solutions be three or four times their bulk of water, the first action of the sun's rays darkens the picture, and then a very bleaching effect follows, giving an exceedingly faint positive picture, which is brought out with great delicacy by the silver solution.

It is necessary that pure water should be used for the fixing, as the presence of any muriate damages the picture, and here arises another pleasing variation of the Chromatype. If the positive picture be placed in a very weak solution of common salt the image slowly fades out, leaving a faint negative outline. If it now be removed from the saline solution, dried, and again exposed to sunshine, a positive picture of a lilac color will be produced by a few minutes exposure. Several other of the chromates may be used in this process, but none is so successful as the chromate of copper.

IV. ANTHOTYPE.

The expressed juice, alcholic, or watery infusion of flowers, or vegetable substances, may be made the media of photogenic action. This fact was first discovered by Sir John Herschel. We have already given a few examples of this in the third chapter.

Certain precautions are necessary in extracting the coloring matter of flowers. The petals of fresh flowers are carefully selected, and crushed to a pulp in a marble mortar, either alone or with the addition of a little alcohol, and the juice expressed by squeezing the pulp in a clean

linen or cotton cloth. It is then to be spread upon paper with a flat brush, and dried in the air without artificial heat. If alcohol be not added, the application on paper must be performed immediately, as the air (even in a few minutes), irrecoverably changes or destroys their color. If alcohol be present this change is much retarded, and in some cases is entirely prevented.

Most flowers give out their coloring matter to alcohol or water. Some, however, refuse to do so, and require the addition of alkalies, others of acid, &c. Alcohol has, however, been found to enfeeble, and in many cases to discharge altogether these colors; but they are, in most cases, restored upon drying, when spread over paper. Papers tinged with vetegable colors must always be kept in the dark, and perfectly dry.

The color of a flower is by no means always, or usually, that which its expressed juice imparts to white paper. Sir John Herschel attributes these changes to the escape of carbonic acid in some cases; to a chemical alteration, depending upon the absorption of oxygen, in others; and again in others, especially where the expressed juice coagulates on standing, to a loss of vitality, or disorganization of the molecules. To secure an eveness of tint on paper, the following manipulation is recommended:—The paper should be moistened on the back by sponging and blotting off. It should then be pinned on a board, the moist side downwards, so that two of its edges (suppose the right-hand and lower ones) shall project a little beyond those of the board. The board then being inclined twenty or thirty degrees to the horizon, the alcoholic tincture (mixed with a very little water, if the petals themselves be not very juicy) is to be applied with a brush in strokes from left to right,

taking care *not to go* over the edges which rest on the board; but to pass clearly over those that project; and observing also to carry the tint from below upwards by quick sweeping strokes, leaving no dry spaces between them, but keeping up a continuity of wet spaces. When all is wet, cross them by another set of strokes from above downwards, so managing the brush as to leave no floating liquid on the paper. It must then be dried as quickly as possible over a stove; or in a warm current of air, avoiding, however, such heat as may injure the tint.

In addition to the flowers already mentioned in my third chapter, the following are among those experimented upon and found to give tolerable good photographic sensitives. I can only enumerate them, referring the student, for any further information he may desire on the subject, to Mr. Hunt's work; although what I have said above is sufficient for all practical purposes; and any one, with the ambition, can readily experiment upon them, without further research, on any other flower he may choose.

Viola Odorata—or sweet sented violet, yields to alcohol a rich blue color, which it imparts in high perfection to paper

Senecio Splendens—or double purple groundsel, yields a beautiful color to paper.

The leaves of the laurel, common cabbage, and the grasses, are found sufficiently senstive.

Common Merrigold yields an invaluable fæcula, which appears identical with that produced by the Wall-flower, and Cochorus japonica mentioned before, and is very sensitive, but photographs procured upon it cannot be preserved, the color is so fugitive.

From an examination of the researches of Sir John Herschel on the coloring matter of plants, it will be seen that the action of the sun's rays is to destroy the color, effecting a sort of chromatic analysis, in which two distinct elements of color are separated, by destroying the one and leaving the other outstanding. The action is confined within the visible spectrum, and thus a broad distinction is exhibited between the action of the sun's rays on vegetable juices and on argentine compounds, the latter being most sensibly affected by the invisible rays beyond the violet.

It may also be observed, that the rays effective in destroying a given tint, are in a great many cases, those whose union produces a color complimentary to the tint destroyed, or, at least, one belonging to that class of colors to which such complementary tint may be preferred. For instance, yellows tending towards orange are destroyed with more energy by the blue rays ; blues by the red, orange and yellow rays ; purples and pinks by yellow and green rays.

V. AMPHITYPE.

This process is a discovery of Sir John Herschel and receives its name from the fact that both negative and positive photographs can be produced by one process. The positive pictures obtained by it have a perfect resemblance to impressions of engravings with common printer's ink. The process, although not yet fully carried out, promises to be of vast utility.

Paper proper for producing an amphitype picture may be prepared either with the ferro-tartrate or the ferro-citrate of the protoxide, or the peroxide of mercury, or of the protoxide of lead, by using creams of these salts, or by successive applications of the nitrates of the respec-

tive oxides, singly or in mixture, to the paper, alternating with solutions of the ammonia-tartrate or the ammonia-citrate of iron, the latter solution being last applied, and in more or less excess I purposely avoid stating proportions, as I have not yet been able to fix upon any which certainly succeed. Paper so prepared and dried takes a negative picture, in a time varying from half an hour to five or six hours, according to the intensity of the light; and the impression produced varies in apparent force from a faint and hardly perceptible picture to one of the highest conceivable fulness and richness both of tint and detail, the color being in this case a superb velvety brown. This extreme richness of effect is not produced unless lead be present, either in the ingredients used, *or in the paper itself.* It is not, as I originally supposed, due to the presence of free tartaric acid. The pictures in this state are not permanent. They fade in the dark, though with very different degrees of rapidity, some (especially if free tartaric or citric acid be present) in a few days, while others remain for weeks unimpaired, and require whole years for their total obliteration. But though entirely faded out in appearance, the picture is only rendered dormant, and may be restored, changing its character from negative to positive, and its colors from brown to black, (in the shadows), by the following process:—A bath being prepared by pouring a small quantity of solution of pernitrate of mercury into a large quantity of water, and letting the subnitrated precipitates subside, the picture may be immersed in it, (carefully and repeatedly clearing off all air bubbles,) and allowed to remain till the picture (if any where visible,) is entirely destroyed; or if faded, till it is judged sufficient from previous experience; a term which is often marked

by the appearance of a feeble positive picture, of a bright yellow hue, on the pale yellow ground of the paper. A long time (several weeks) is often required for this, but heat accelerates the action, and it is often completed in a few hours. In this state the picture is to be very thoroughly rinsed and soaked in pure warm water, and then dried. It is then to be well ironed with a smooth iron, heated so as barely not to injure the paper, placing it, for greater security against scorching, between clean smooth paper. If then the process have been successful, a perfectly black positive picture is at once developed. At first it most commonly happens that the whole picture is sooty or dingy to such a degree that it is condemned as spoiled, but on keeping it between the leaves of a book, especially in a moist atmosphere, by extremely slow degrees this dinginess disappears, and the picture disengages itself with continually increasing sharpness and clearness, and acquires the exact effect of a copper-plate engraving on a paper more or less tinted with a pale yellow.

I ought to observe, that the best and most uniform specimens which I have procured have been on paper previously washed with certain preparations of uric acid, which is a very remarkable and powerful photographic element. The intensity of the original negative picture is no criterion of what may be expected in the positive It is from the production by one and the same action of light, of either a positive or negative picture according to the subsequent manipulations, that I have designated the process, thus generally sketched out, by the term *Amphitype*,—a name suggested by Mr. Talbot, to whom I communicated this singular result; and to this process or class of processes (which I cannot doubt when pur-

sued will lead to some very beautiful results,) I propose to restrict the name in question, though it applies even more appropriately to the following exceedingly curious and remarkable one, in which silver is concerned :

At the last meeting I announced a mode of producing, by means of a solution of silver, in conjunction with ferro-tartaric acid, a dormant picture brought into a forcible negative impression by the breath or moist air. (*See Cyanotype.*) The solution then described, and which had at that time been prepared some weeks, I may here incidentally remark, has retained its limpidity and photogenic properties, quite unimpaired during the whole year since elapsed, and is now as sensitive as ever,—a property of no small value. Now, when a picture (for example an impression from an engraving) is taken on paper washed with this solution, it shows no sign of a picture on its back, whether that on its face is developed or not; but if, while the actinic influence is still fresh upon the face, (*i.e.*, as soon as it is removed from the light), *the back* be exposed for a very few seconds to the sunshine, and then removed to a gloomy place, *a positive picture, the exact complement of the negative one on the other side*, though wanting of course in sharpness if the paper be thick, *slowly and gradually makes its appearance* there, and in half an hour or an hour acquires a considerable intensity. I ought to mention that the "ferro-tartaric acid" in question is prepared by precipitating the ferro-tartrate of ammonia (ammonia-tartrate of iron) by acetate of lead, and decomposing the precipitate by dilute sulphuric acid. When lead is used in the preparation of Amphitype paper, the parts upon which the light has acted are found to be in a very high degree *rendered water proof.—Sir J. Herschel*

This process is a new invention of our countryman, J. A. Whipple, Esq., of Boston, and has been patented by M. A. Root, Esq., of Philadelphia. It will be seen, however, from the previous pages of my work that Mr. Root is mistaken in regard to his being the first improvement patented in this country, althongh it is unquestionably the first by an American. Of this improvement Mr. Root says:

VI. "CRAYON DAGUERREOTYPE."

"The improvement to which you refer is denominated "The Crayon Daguerreotype." This invention made by Mr. J. A. Whipple, is the only improvement in Daguerreotyping, I believe, for which Letters Patent for the United States were ever issued. The pictures produced by this process—which is of the simplest description imaginable—have the appearance and effect of very fine "Crayon Drawings," from which the improvement takes its name. Some of our most distinguished artists have given it their unqualified admiration. Among them, our Mezzotinto Engravers, especially John Sartain, Esq., who, from his rich embellishments to most of the leading Magazines and Annuals of the country, as well as from the celebrity of the superb Magazine which bears his name, is so well known and so well qualified to judge of its merits. As an auxiliary to the artist, in furnishing heads to the Magazines, or other works, it is invaluable; the great object which it accomplishes being to give a finer effect and more distinct expression to all the features—the whole power of the instrument being directed to, and confined to the head."

"The late hour at which this subject has been brought to our notice prevents so full a description as we would otherwise have been glad to furnish. The New England

States have been disposed of; negotiations for any of the others can be made through M. A. Root, 140 Chestnut street, Philadelphia."

" A series of beautiful portraits are about being prepared by the " Crayon Process" for the express purpose of being placed on the exhibition at the " *Art Union*," when amateurs, artists, and the public generally will have an opportunity of witnessing its effect. We are especially gratified with this striking improvement, from the advantages which it promises to the Daguerrean art."

" It is admirably designed to excite a new interest on the subject through the community, and in this way—and from its tendency to render the art more generally useful, and to elevate and distinguish it—to make it to all a matter of more general importance."

" Yours respectfully,

" M. A. Root."

In our second edition, we hope—with Mr. Root's permission—to lay the whole process before the public, although our artists must bear in mind that Mr. Root's patent secures to him the exclusive right of its application.

CHAP. XI.

ON THE PROBABILITY OF PRODUCING COLORED PICTURES BY THE SOLAR RADIATIONS — PHOTOGRAPHIC DEVIATIONS — LUNAR PICTURES — DRUMMOND LIGHT.

Having before noticed the fact that some advances had been made towards taking Daguerreotypes in color, by means of solar rays, and expressed the hope that the day was not far distant when this might be accomplished, I here subjoin Mr. Hunt's remarks on this subject.

Mr. Biot, in 1840, speaking of Mr. Fox Talbot's beautiful calotype pictures, considers as an illusion "the hope to reconcile, not only the intensity but the tints of the chemical impressions produced by radiations, with the colors of the object from which these radiations emanated." It is true that three years have passed away, and we have not yet produced colored images; yet I am not inclined to consider the hope as entirely illusive.

It must be remembered that the color of bodies depends entirely upon the arrangement of their molecules. We have numerous very beautiful experiments in proof of this. The bi-niodide of mercury is a fine scarlet when precipitated. If this precipitate is heated between plates of glass, it is converted into crystals of a fine sulphur yellow, which remain of that color if undisturbed, but which becomes very speedily scarlet if touched with any pointed instrument. This very curious optical phenome-

na has been investigated by Mr. Talbot and by Mr. Warrington. Perfectly dry sulphate of copper is white; the slightest moisture turns it blue. Muriate of cobalt is of a pale pink color; a very slight heat, by removing a little moisture, changes it to a green. These are a few instances selected from many which might be given.

If we receive a prismatic spectrum on some papers, we have evidence that the molecular or chemical disturbance bears some relation to the color of each ray, or, in other words, that colored light so modifies the action of ENERGIA that the impression it makes is in proportion to the color of the light it accompanies, and hence there results a molecular arrangement capable of reflecting colors differently. Some instances have been given in which the rays impressed correspond with the colors of the luminous rays in a very remarkable manner.* One of the most decided cases is that of the paper prepared with the fluoride of soda and nitrate of silver. Sir John Herschel was, however, the first to obtain any good specimens of photographically impressed prismatic colorations.

It was noticed by Daguerre that a red house gave a reddish image on his iodized silver plate in the camera obscura; and Mr. Talbot observed, very early in his researches, that the red of a colored print was copied of a red color, on paper spread with the chloride of silver.‡

" In 1840 I communicated to Sir John Herschel some very curious results obtained by the use of colored media, which he did me the honor of publishing in one of

* See Mr. Hunt's " Researches on Light."

‡ In 1842, I had shown me a picture of a house in the Bowery, which had been repaired a few days previous, and in the wall a red brick left. This brick was brought out on the Daguerreotype plate of precisely the same color as the brick itself. The same artist also exhibited to me, the full length portrait of a gentleman who wore a pair of pantaloons having a blue striped figure. This blue stripe was fully brought out, of the same color, in the picture.—AMER. ED.

his memoirs on the subject from which I again copy it."

"A paper prepared with muriate of barytes and nitrate of silver, allowed to darken whilst wet in the sun shine to a chocolate color, was placed under a frame containing a red, a yellow, a green, and a blue glass. After a week's exposure to diffused light, it became red under the red glass, a dirty yellow under the yellow glass, a dark green under the green, and a light olive under the blue.

"The above paper washed with a solution of salt of iodine, is very sensitive to light, and gives a beautiful picture. A picture thus taken was placed beneath the above glasses, and another beneath four flat bottles containing colored fluids. In a few days, under the red glass and fluid, the picture became a dark blue, under the yellow a light blue, under the green it remained unchanged, whilst under the blue it became a rose red, which in about three weeks changed into green. Many other experiments of a similar nature have been tried since that time with like results.

"In the summer of 1843, when engaged in some experiments on papers prepared according to the principles of Mr. Talbot's calotype, I had placed in a camera obscura a paper prepared with the bromide of silver and gallic acid. The camera embraced a picture of a clear blue sky, stucco-fronted houses, and a green field. The paper was unavoidably exposed for a longer period than was intended—about fifteen minutes,—a very beautiful picture was impressed, which, when held between the eye and the light, exhibited a curious order of colors. The sky was of a crimson hue, the houses of a slaty blue. and the green fields of a brick red tint. Surely these results appear to encourage the hope, that we may even-

tually arrive at a process by which external nature may be made to impress its images on prepared surfaces, in all the beauty of their native coloration."

PHOTOGRAPHIC DEVIATIONS.

Before taking leave of the subject of photogenic drawing, I must mention one or two facts, which may be of essential service to operators.

It has been observed by Daguerre, and others, in Europe, and probably by some of our own artists, that the sun two hours after it has passed the meridian, is much less effective in the photographic process, than it is two hours previous to its having reached that point. This may depend upon an absorptive power of the air, which may reasonably be supposed to be more charged with vapor two hours before noon. The use of the hygrometer may possibly establish the truth or falsity of this supposition. The fact, however, of a better result being produced before noon being established, persons wishing their portraits taken, will see the advantage of obtaining an early sitting, if they wish good pictures. On the other hand, if the supposition above mentioned prove true, a too early sitting must be avoided.

If we take a considerable thickness of a dense purple fluid, as, for instance, a solution of the ammonia-sulphate of copper, we shall find that the quantity of light is considerably diminished, at least four-fifths of the luminous rays being absorbed, while the chemical rays permeate it with the greatest facility, and sensitive preparations are affected by its influence, notwithstanding the deficiency of light, nearly as powerfully as if exposed to the undecomposed sunbeams.

It was first imagined that "under the brilliant sun and clear skies of the south, photographic pictures would

be produced with much greater quickness than they could be in the atmosphere of Paris. It is found, however, that a much longer time is required. Even in the clear and beautiful light of the higher Alps, it has been proved that the production of the photographic picture requires many minutes more, even with the most sensitive preparations, than it does in London. It has also been found that under the brilliant light of Mexico, twenty minutes, and half an hour, are required to produce effects which in England would occupy but a minute; and travellers engaged in copying the antiquities of Yucatan have on several occasions abandoned the use of the photographic camera, and taken to their sketch books. Dr. Draper* has observed a similar difference between the chemical action of light in New York and Virginia. This can be only explained by the supposition that the intensity of the light and heat of these climes interferes with the action of the Energic rays on those sensitive preparations which are employed.

LUNAR PICTURES—DRUMMOND LIGHT.

The Roman Astronomers state that they have procured Daguerreotype impressions of the Nebula of the sword of Orion. Signor Rondini has a secret method of receiving photographic images on lithographic stone; on such a prepared stone they have succeeded in impressing an image of the Nebula and its stars; "and from that stone they have been enabled to take impressions on paper, unlimited in number, of singular beauty, and of perfect precision." Experiments have, however, proved that "no heating power exists in the moon's rays, and that lunar light will not act chemically upon the iduret of silver."

* I would here take occasion to remark that our countryman, Dr. Draper, is very frequently quoted by Mr, Huut in his "Researches."

It was at one time supposed that terrestrial or artificial light possessed no chemical rays, but this is incorrect—Mr. Brande discovered that although the concentrated light of the moon, or the light even of olefiant gas, however intense, had no effect on chloride of silver, or on a mixture of chloride and hydrogen, yet the light emitted by electerized charcoal blackens the salt. At the Royal Polytechnic Institution pictures have been taken by means of sensitive paper acted upon by the Drummond Light; but it must of course be distinctly understood, that they are inferior to those taken by the light of the sun, or diffused daylight.

If our operators could manage to produce good pictures in this way they would put money in their pockets, as many who cannot find time during the day would resort to their rooms at night. I throw out the hint in hopes some one will make the experiment.

I have learned, since the above was written, that an operator in Boston succeeded a short time since in procuring very good pictures by the aid of the Drummond Light; but that the intensity of the light falling directly upon the sitter's face caused great difficulty, and he abandoned it. This may, probably, be remedied by interposing a screen of very thin tissue paper tinged slightly of a bluish color.

TO TAKE COLORED DAGUERREOTYPES.

Since our first edition was published, the following process has been discovered in Europe:

"A silver plate, such as is employed in the Daguerreotype process, is connected by a copper wire with one pole of a galvanic battery; a piece of platina foil being connected by a copper wire likewise, with the other pole. A

solution of muriatic acid in water being prepared—about one part acid to two of water—the plate and platina are plunged into it, and brought near each other, but not in contact. Of course, the circuit being made up through the acid solution, a chemical action is established over the surface of the silver plate; the chlorine of the decomposed muriatic acid attacking the silver and forming chloride of silver over the surface. As the film of chloride of silver is produced, and gradually thickens, it passes through the colors of Newton's thin plates, and at length assumes a lilac, which is the sensitive coating. These plates have not yet been rendered sufficiently sensitive to ensure any action, except from the direct rays of the sun. But if a prismatic spectrum, of a well defined character, is allowed to fall upon the prepared plate, it will be found, after an exposure of a few minutes, that a distinct impression of the seven colored rays are obtained in *color*, every ray being represented by its own color on the plate, the red being the most intense, and the yellow the least so.

CHAP. XII.

ON COLORING DAGUERREOTYPES.

Nearly, if not quite all the various colors used in painting may be made from the five primitive colors, black, white, blue, red and yellow, but for the Daguerrean artist it would be the best policy to obtain such as are required by their art already prepared. In a majority of cases, the following will be found sufficient, viz.

Carmine.

Prussian Blue.

White.

Chrome Yellow, Gamboge, Yellow Ochre; or all three.*

Light Red.

Indigo.

Burnt Sienna.

Bistre, or Burnt Umber.

If, in coloring any part of a lady's or gentleman's apparel, it is found necessary to produce other tints and shades, the following combinations may be used:

Orange—Mix yellow with red, making it darker or lighter by using more or less red.

Purple—This is made with Prussian blue, or indigo and red. Carmine and Prussian blue producing the

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* Gamboge is best for drapery; Ochre for the face.

richest color, which may be deepened in the shadows by a slight addition of indigo or brown.

Greens—Prussian blue and gamboge makes a very fine green, which may be varied to suit the taste of the sitter or operator, by larger portions of either, or by adding white, burnt sienna, indigo, and red, as the case may require. These combinations, under different modifications, give almost endless varieties of green.

Brown—May be made of different shades of umber, carmine and lamp-black.

Neutral tint—Is composed of indigo and lamp-black.

Crimson—Mix carmine and white, deepening the shaded parts of the picture with additional carmine.

Flesh Color—The best representative of flesh color is light red, brightened in the more glowing or warmer parts, with carmine, softened off in the lighter portions with white, and shaded with purple and burnt sienna.

Lead Color—Mix indigo and white in proportions to suit.

Scarlet—Carmine and light red.

For Jewelry cups of gold and silver preparations accompany each box for Daguerreotypists, or may be procured separately.

The method of laying colors on Daguerreotypes is one of considerable difficulty, inasmuch as they are used in the form of perfectly dry impalpable powder. The author of this little work is now experimenting, in order, if possible, to discover some more easy, artistic and unexceptionable method. If successful, the result will be published in a future edition.

The rules we shall give for coloring Daguerreotypes depends, and are founded, upon those observed in miniature painting, and are intended more as hints to Da-

guerrean artists, in hopes of leading them to attempt improvements, than as instructions wholly to be observed.

The writer is confident that some compound or ingredient may yet be discovered which, when mixed with the colors, will give a more delicate, pleasing, and natural appearance to the picture than is derived from the present mode of laying them on, which in his estimation is more like plastering than coloring.

In Coloring Daguerreotypes, the principal shades of the head are to be made with bistre, mixed with burnt sienna, touching some places with a mixture of carmine and indigo. The flesh tints are produced by the use of light red, deepened towards the shaded parts with yellow ochre, blue and carmine mixed with indigo, while the warmer, or more highly colored parts have a slight excess of carmine or lake. Color the shades about the mouth and neck with yellow ochre, blue, and a very little carmine, heightening the color of the lips with carmine and light red, letting the light red predominate on the upper, and the carmine on the lower lip ; the shades in the corner of the mouth being touched slightly with burnt sienna, mixed with carmine.

In coloring the eyes, the artist will of course be guided by nature, observing a very delicate touch in laying on the colors, so as to preserve as much transparency as possible. A slight touch of blue—ultramarine would be best if it would adhere to the Daguerreotype plate—in the whites of the eye near the iris, will produce a good effect.

In coloring the heads of men it will be necessary to use the darker tints with more freedom, according to the complexion of the sitter. For women, the warmer tints should predominate, and in order to give that transpa-

rency so universal with the softer sex—and which gives so much loveliness and beauty to the face—a little white may be judiciously intermingled with the red tints about the lighter portions of the face.

In taking a picture of a lady with light or auburn hair, by the Daguerrean process, much of the beauty of the face is destroyed, on account of the imperfect manner in which light conveys the image of light objects to the spectrum of the camera. This may be obviated in some measure by proper coloring. To do this, touch the shaded parts with burnt sienna and bistre, filling up the lighter portions with yellow ochre, delicate touches of burnt sienna, and in those parts which naturally have a bluish tint, add *very* delicate touches of purple—so delicate in fact as hardly to be perceived. The roots of the hair at the forehead should also be touched with blue, and the eyebrows near the temples made of a pinkish tint.

The chin of a woman is nearly of the same color as the cheeks in the most glowing parts. In men it is stronger, and of a bluish tint, in order to produce the effect given by the beard.

In portraits of women—the middle tints on the side of the light, which are perceived on the bosom and arms, are made of a slight mixture of ochre, blue and lake, (or carmine), to which add, on the shaded sides, ochre, bistre and purple, the latter in the darker parts. The tints of the hands should be the same as the other parts of the flesh, the ends of the fingers being a little pinkish and the nails of a violet hue. If any portion of the fleshy parts is shaded by portions of the dress, or by the position of the hand, this shade should be colored with umber mixed with purple.

To Color the Drapery.—*Violet Velvet*—Use purple made of Prussian blue and carmine, touching up the shaded parts with indigo blue.

Green Velvet—Mix Prussian blue and red-orpiment, shade with purple, and touch up the lights with a little white.

Red Velvet—Mix a very little brown with carmine, shading with purple, marking the lights in the strongest parts with *pure* carmine, and touch the most brilliant slightly with white.

White Feathers—May be improved by delicately touching the shaded parts with a little blue mixed with white. *White* muslin, linen, lace, satin, silk, etc., may also be colored in the same way, being careful not to lay the color on too heavily.

Furs—*Red Furs* may be imitated by using light red and a little masticot, shaded with umber. *Gray Furs*—black and white mixed and shaded with bistre. *Sable*—white shaded lightly with yellow ochre.

These few directions are quite sufficient for the art, and it is quite unnecessary for me to pursue the subject further. I would, however, remark that the Daguerreotypists would find it greatly to their advantage to visit the studies of our best artists, our public galleries of paintings, and statuary, and wherever else they can obtain a sight of fine paintings, and study the various styles of coloring, atitudes, folds of drapery and other points of the art. In coloring Daguerreotypes, artists will find the magnifying glass of much advantage in detecting any imperfections in the plate or in the image, which may be remedied by the brush. In selecting brushes choose those most susceptible of a fine point, which may be ascertained by wetting them between the lips, or in a glass of water.

CHAP. XIII.

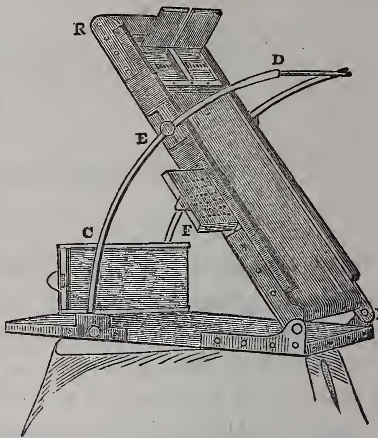
THE PHOTOGRAPHOMETER.

The last number (for March, 1849) of the " London Art-Journal, gives the following description of a recent improvement in Photographic Manipulation, and as I am desirous of furnishing everything new in the art, I stop the press to add it, entire, to my work.

" Since the photographic power of the solar rays bears no direct relation to their luminous influence, it becomes a question of considerable importance to those who practice the beautiful art of photography, to have the means of rèadily measuring the ever changing activity of this force. Several plans more or less successful, have been devised by Sir John Herschel, Messrs. Jordan, Shaw and Hunt. The instrument, however, which is now brought forward by Mr. Claudet, who is well known as one of our most successful Daguerreotypists, appears admirably suited to all those purposes which the practical man requires. The great difficulty which continually annoys the photographic amateur and artist, is the determination of the sensibility of each tablet employed, relatively to the amount of radiation, luminous and chemical, with which he is working. With the photographometer of Mr. Claudet this is easily ascer-

tained. The following woodcuts and concise description will sufficiently indicate this useful and simple apparatus.

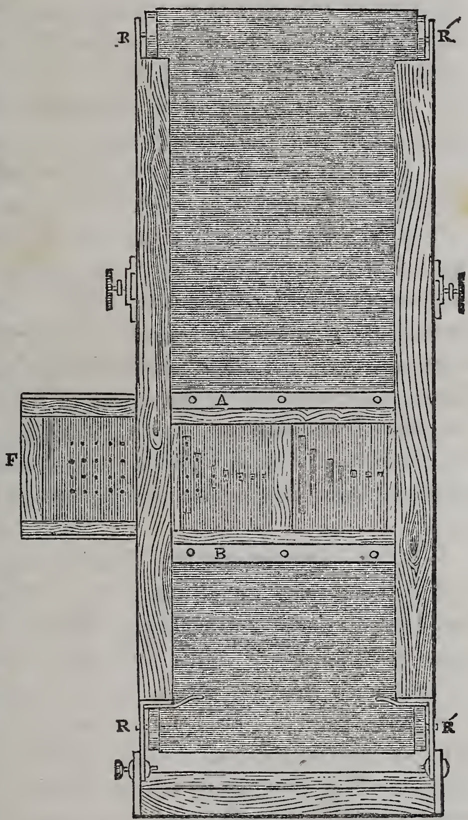
Fig. 29



" For an instrument of this kind it is important in the first place to have a motion always uniform, without complicated or expensive mechanism.— This is obtained by means founded upon the principle of the fall of bodies sliding down an inclined plane. The sensitive surface is exposed to the light by the rapid and uniform passage of a metal plate, A, B, (*Fig.* 30,) having openings of different length, which follow a geometric progression. It is evident that the exposure to light will be the same for each experiment, because the plate furnished with the proportional openings falls always with the same rapidity, the height of the fall being constant, and the angle of the inclined plane the same. Each opening of this moveable plate allows the light to pass during the same space of time, and the effect upon the sensitive surface indicates exactly the intensity of the chemical rays. The rapidity of the fall may be augmented or diminished by altering the inclination of the plane by means of a graduated arc, C, D, (*Fig.* 29,) furnished with a screw, E, by which it may be fixed at any angle. The same result may be obtained by modifying the height of the fall or the weight

of the moveable plate. The photogenic surface, whether

Fig. 30.



it be the Daguerreotype plate, the Talbotype paper, or any other preparation sensitive to light, is placed near the bottom of the inclined plane, F. It is covered by a thin plate of metal, pierced with circular holes, which correspond to the openings of the moveable plate at the moment of the passage of the latter, during which the sensitive surface receives the light wherever the circular holes leave it exposed.

" The part of the apparatus which contains the sensitive surface is an independent frame. and it slides from a dark box into an opening on the side of the inclined plane

" A covering of black cloth impermeable to lightis, attached to the sides of the moveable plate, enveloping the whole inclined plane, rolling freely over two rollers, R, R, placed the one at the upper and the other at the lower part of the inclined plane. This cloth prevents the light striking the sensitive surface before and after the passage of the moveable plate.

" It will be seen that this apparatus enables the experimentalist to ascertain with great precision the exact length of time which is required to produce a given amount of actinic change upon any sensitive photographic surface, whether on metal or paper. Although at present some calculation is necessary to determine the difference between the time which is necessary for exposure in direct radiation, and to the action of the secondary radiations of the camera obscura; this is, however, a very simple matter, and it appears to us exceedingly easy to adapt an instrument of this description to the camera itself.

" By this instrument Mr. Claudet has already determined many very important points. Among others, he has proved that on the most sensitive Daguerreotype plate an exposure of .0001 part of a second is sufficient to produce a decided effect.

" Regarding photography as an auxiliary aid to the artist of no mean value, we are pleased to record a description of an instrument which, without being complicated, promises to be exceedingly useful. In this opinion we are not singular; at a recent meeting of the Photographic Club, to which this instrument was exhibited, it was with much real satisfaction that we learned that several of our most eminent artists were now eager and most successful students in Photography. The

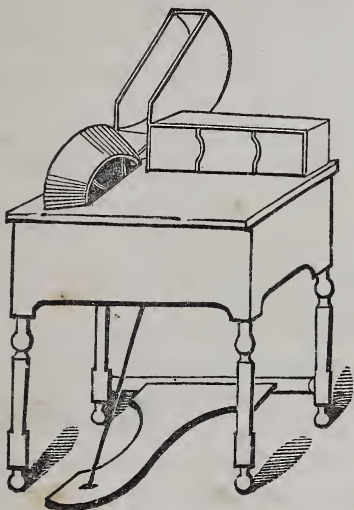
beautiful productions of the more prominent members of this club excited the admiration of all, particularly the copies of architectural beauties, and small bits of landscape, by Messrs. Cundell and Owen. We think that now the artist sees the advantage he may derive from the aid of science, that both will gain by the union."

I hope the above description will induce our townsman, Mr. Roach, to successfully produce an instrument that will meet the wants of our artists in that part of the Daguerrean process referred to.

DAVIE'S IMPROVED BUFFING LATHE.

This is a recent and decided improvement for polishing plates, accurately figured at 31.

Fig. 31.



There is no part of the Daguerreotype process requiring more thorough manipulation than that of cleaning and polishing the plate, and none wherein the operator has met with less satisfaction. The hand buff, though good, does not give that finely finished surface so desirable in a good picture; and the lathes commonly used, are apt, in some instances, to go to the other extreme, and wear the plate bare of silver. Of the many efforts made to improve the buffing-wheel, none have come so near perfection as the above alluded to.

It occupies but little space, and requires slight exertion. The buffer is a cone of cast iron, twenty-three inches in diameter, neatly covered with wood, and forming a free surface six and a half inches wide. This cone runs in a well adapted case, which stands firmly on four handsomely turned legs, attached to the box by screws. The cone is turned by a treadle with the left foot. Connected with the machine, are four holders for the different sizes of plates. It is certainly a very neat affair, and will undoubtedly do its work quicker and better than anything of the kind now in use.

CHAP. XIV.

RECIPES.

Since the publication of the first edition of the Art of Photography, so many inquiries have been made for the recipes used in the art, I have deemed it advisable to append everything of the kind to the present issue, that can possibly be of any benefit to the operator. I would, however, express the opinion, that in most instances it would be preferable to purchase the compounds of good chemists, or the dealers in Daguerreotype stock, than to trust to your own compounding. However, those who wish to make experiments, or search into effects and causes, will herein find ample scope for their ambition.

BROMINE.

Bromine is prepared by passing a current of chlorine through the unchrystalizable residuum of sea-water, called *bittern*, which then assumes an orange tint, in consequence of bromine being set free from its combinations; *sulphuric ether* is then agitated with it, and the mixture is allowed to stand until the ethereal portion holding the bromine in solution floats upon the surface. This is then carefully decantered, and agitated with a solution of *potassium*, by which means bromide of potassium and bromate of potash are formed. The whole is next evaporated to dryness, and submitted to a dull heat; the residuum is

then powdered, mixed with pure *peroxide of manganese,* and placed in a retort; *sulphuric acid,* diluted with half its weight of water, is now poured in. Red vapors immediately arise, are condensed into drops of bromine, and are collected by plunging the neck of the retort to the bottom of a small receiver containing cold water. The bromine forms a stratum beneath the water, and may be collected and purified by distillation from dry chloride of calcium.

Bromide of Iodine.—See page 67.

Bromide of Lime.—See page 68.

Another method of preparing this favorite, and undoubtedly one of the very best accelerators used in the art, is, after observing the directions on page 68, to drop *Hydrofluoric acid* into the mixture until it becomes a light orange, approaching red ochre color. A small piece of alum, finely powdered, and well shaken in, will benefit it materially.

Bromine, Chloride of.—Transmit a current of *dry chlorine* through *bromi,* and condense the disengaged vapors in a receiver surrounded with ice. A volatile reddish fluid is produced, which may be diluted with water in the proportions given on page 68, and it is ready for the coating-box.

CHLORINE.

To obtain this, mix together in a glass flask or retort, strong muriatic acid, with half its weight of finely powdered peroxide of manganese. The tube of the flask must be inserted into a clean dry glass bottle, reaching nearly to its bottom. Chlorine gas is immediately evolved, and being heavier than the air, will displace the latter without mixing with it. When the bottle is full, which may be

known by the gas overflowing the mouth, the tube should be removed into another bottle, and the full one securely closed with a ground stopper, previously greased. Continue thus to fill your bottles until you have the desired quantity. Several other methods are used for procuring this gas, but the above is simple and sufficient.

Liquid Chlorine may be made by mixing 87 parts of sulphuric acid with 124 parts of water, and pouring it upon 100 parts of dry muriate of soda and 30 parts of oxide of manganese, previously mixed together and placed in a retort. Conduct the gas evolved into 200 parts distilled water.

CHLORIDE OF GOLD.

This is a very simple compound, and may be made as follows:

Take three parts nitro-muriatic acid, put it into a cup, and drop into it a piece of pure gold one-third its weight, and let it evaporate until chlorine vapor begins to be disengaged; then set it aside to chrystalize. Care should be taken to place the cup in a draught of air, that you may not be troubled by the fumes arising from it. A gentle heat may be applied to the bottom of the cup by means of your spirit-lamp, taking care not to get it too hot; or, the cup may be put into a saucepan of boiling water, sufficiently small to permit the cup to rest on its rim, with about three-fourths the body of the latter immersed.

The crystals of chloride of gold made in this way, are of an orange-red color, and may be dissolved in water fifteen grains to a pint. To this, add forty-five grains hyposulphite of soda, and when thoroughly combined, filter the mixture through bibulous paper till it becomes

colorless. Gild the picture over the spirit-lamp until the bubbles are well defined over the plate.

THOMPSON'S CHLORIDE OF GOLD.

Take one dollar's worth virgin gold, put it in a porcelain cup, and pour on about an ounce of nitro-muriatic acid. Place a feeble alcoholic flame under it, just enough to make it simmer—stir it occasionally with a glass rod; when the gold is all dissolved, add about one hundred grains common salt; if there is not sufficient acid to saturate the salt, add more, stirring it with your glass rod until it is perfectly dry. It is then ready to bottle. To fifty grains of hyposulphite of soda dissolved in a pint of water, put eighteen grains of chloride of gold. Filter as usual.

HYPOSULPHITE OF GOLD.

Take 85 parts terchloride of gold and 16 parts sodium; dissolve them in a little distilled water, and evaporate over a gentle heat until a pellicle forms; then put it aside to chrystalize.

ANOTHER.

Dissolve a given quantity of chloride in an excess of distilled water, and add four times its weight of hyposulphite of soda previously dissolved in distilled water to excess. Into this, drop the gold solution, shaking it up well at intervals. After letting it stand in the dark until it is bleached, filter and evaporate to dryness. To this residuum add 200 times its weight of distilled water, and three grains burnt alum; agitate and evaporate to dryness as before. Twenty-five grains of this salt will make a quart of strong solution, which should be filtered till it becomes colorless. Use as directed on page 74.

IODINE.

This chemical element is found in animal, vegetable and mineral substances, but exists in the greatest abundance in the vegetable. It is prepared by extracting all the soluble part of kelp by water, and crystalizing the soda by evaporation; to the mother-lye add oil of vitriol in excess—say, one ounce of vitriol to eight of lye—and boil the liquid; then strain it and mix the filtered liquor with as much manganese as there was oil of vitriol used; on applying heat, the iodine sublimes in the form of grayish black scales, with a metallic lustre.

The boiling is conducted in a leaden vessel; and a cylindrical leaden still, with a very *short head*, and connected with two or three globular glass receivers, is used for the subliming apparatus. Care must be taken to watch the process, and prevent the neck of the still becoming choked with condensed iodine.

CHLORIDE OF IODINE.

When dry chlorine is passed over dry iodine, at common temperature, heat is evolved, and a solid chloride results. It is orange yellow when the iodine is fully saturated, and reddish orange when the iodine is in excess.—The process is effected by placing the iodine in a flask, and attached to a retort containing chlorine.

THOMPSON'S ACCELERATOR.

This is one of the best sensitives we know of, and Mr. Thompson will accept our thanks for contributing it to our work.

Make a strong solution of lime in one quart of water—add to it half an ounce of chloride of iodine, and then

drop in sufficient bromine to take up the chloride of iodine; the best way is to first put in the one-eighth of an ounce of bromine, and add a few drops daily until the chloride of iodine is taken up—care being taken not to get too much—then put in sixty grains nitrate of silver, shake it well, and add thirty drops nitro-muriatic acid. Put in the box about a tablespoonful of pulverized alum, and add one part quick with six of water. Coat over dry iodine to a light lemon color, then over the quick to a deep orange, and back over the iodine one quarter the time required by the quick.

THOMPSON'S DRY QUICK.

Take a lump of lime and soak it in alcohol about two hours, then expose it to the air until it is as fine as flour. To one pint of lime add half ounce bromine and three tablespoonsful pulverized alum. Put one-third of this into a half-plate box, and as it becomes weak, add more, and so on until you have the whole pint. After this, a few drops of bromine occasionally will make it last six months.

HYPOSULPHITE OF SODA.

This may be made by boiling a diluted solution of caustic soda with sulphur until saturated; then pass sulphurous acid gas into the solution until it is strongly impregnated. Filter a small portion of the mixture, and if it have a *pale* yellow color, you may filter the whole, and evaporate it by boiling to syrupy consistence. If there remains any sulphuret of soda, mix the syrup with half its weight of alcohol, shake it well, and then set it aside to crystalize.

NITRATE OF SILVER.

Digest pure metallic silver in one and a half times its weight of nitric acid diluted with water, and evaporate the solution to dryness. Nitrate of silver is soluble in its own weight of cold water, and half its weight of hot, and also in four times its weight of alcohol.

OXIDE OF SILVER.

This oxide may be obtained by adding to a solution of the nitrate of silver pure barytic water, or lime water; it may be obtained, also, from its solution in nitric acid, by the addition of the pure alkalies.

CHLORIDE OF SILVER.

To one part oxide silver solution add one part hydrochloric acid. Evaporate to dryness. It is insoluble in water, but may be dissolved in ammonia and hyposulphurous acid.

IODIDE OF SILVER.

This compound is formed by adding a solution of the hydriodate of potash to a solution of nitrate of silver, in about equal proportions.

BROMIC ACID.

Formed by passing five equivalents of oxygen into one of bromine. From bromate of baryta, by means of sulphuric acid, free bromic acid may be obtained.

GALLIC ACID.

This acid is obtained from gall nuts, and consists of four parts carbon, three parts oxygen, and three parts hydrogen. It crystalizes in white plates, is soluble in

three parts boiling, or twenty parts cold water; it is very soluble in alcohol, and sublimes by heat.

CHLORIDE OF POTASSIUM.

Is made by exposing to the action of heat the chlorate of potassa. The oxygen of the acid and the alkali is driven off, leaving a compound of chlorine and potassium in the vessel. It is also procured by putting potassium into dry chlorine gas. It consists of 36 parts of chlorine to 40 of potassium.

CYANIDE POTASSIUM.

Is formed by heating to redness the peroxide of manganese, and the fero-cyanuret of potassium in an iron bottle. Soluble in water.

BROMIDE OF POTASSIUM.

Put one part bromine, and one part potassium in a glass bottle, and heating them till they combine. Soluble in water and alcohol, and crystalizes from this solution into anhydrous cubic crystals.

IODIDE OF POTASSIUM.

Is made in the same way as the bromide of potassium—iodine being substituted for bromine. Soluble in water and alcohol, and yields colorless cubic crystals.

CHLORATE OF POTASSA.

Pass a current of chlorine gas through a solution of potassa until the alkali is neutralized; boil the solution a few minutes, and then evaporate it until a pellicle forms upon its surface. On cooling, the chlorate crystalizes, and leaves the muriate of potassa in solution. Re-dissolve these crystals in distilled water, and again evaporate to

dryness, and you obtain pure chlorate of potassa in scales of a pearly lustre.

MERCURY.

Mercury exists native, but may be obtained by mixing iron filings, or lime, and native cinnabar, and exposing the mixture to heat in an earthen or iron retort; the sulphur of the cinnabar combines with the iron or lime, and the mercury is distilled over, and must be collected under water, the neck of the retort being immersed in that fluid. Crude mercury, (such as is sold by druggists,) may be distilled in the same way, and obtained perfectly pure.

Pure mercury does not tarnish when exposed to the air, nor does any film collect on the surface when shaken in a bottle.

HYDROFLUORIC ACID.

This acid is prepared by mixing one part fluor-spar with two parts sulphuric acid, in a leaden retort, exposed over a charcoal fire. A powerful corrosive and poisonous acid is distilled over, which must be collected in leaden bottles surrounded with ice. Glass must not be employed, as the acid destroys it—lead only must be used.

CHLORIDE OF CALCIUM.

Is formed by heating lime strongly in chlorine gas, in proportion as 36 to 20. It may also be prepared by heating dry muriate of lime to ignition. It is very deliquescent, and dissolves in a fourth part its weight of water, and is soluble in alcohol.

BUFF-POWDER.

Take two parts rouge, one part calcined ivory, two parts plumbago, one part oxide tin, mix well together, and you have an excellent finishing polish. If you wish to save the trouble of compounding it, buy it of the dealers.

PHOTOGINE.

This is a very fine article for cleaning the plate previous to buffing; those who use it pronounce it superior to the finest rottenstone. It is used with alcohol, precisely in the same manner as the latter.

FOSSIL POWDER.

This is a good article for drying off the plate after using the rottenstone or photogenie, and previous to buffing.— To use it, dust a little over the plate, and wipe it off with a large camel's hair brush. It removes every particle of moisture.

TO MAKE PASTE FOR SEALING PAPER.

Take six parts of the best glue; boil and strain it very clear; add three parts isinglass, also boiled and strained; put them in a double glue pot, with a quarter of a pound fine brown sugar, and boil it very thick; pour it into moulds, and when cold, cut it into cakes of convenient size, and dry them. When desired for sealing paper, dissolve one of the cakes in warm water, and spread it on stout tissue, or other very thin paper.

SEALING-WAX.

Take two parts well powdered gum-shellac, and one part resin, of the whitest kind, and melt them together

over a slow fire, adding one part vermilion, ivory black, verdigris, verditer, masticot, or any other color you may desire. Beeswax is a good substitute for shellac, if the latter is not to be had. Work it into sticks while cooling, if desirable.

TO DISINFECT A ROOM OF BROMINE VAPOR.

Sprinkle ammonia about the room, or burn ground coffee on hot coals.

TO PURIFY WATER.

Put a piece of alum, about the size of a hickory nut, into a pail of water; let it stand for half an hour, and then decant it carefully into another vessel. To neutralize any carbonates that may be held in solution, add four or five drops of nitric acid for every quart of water.

As pure or soft water is absolutely necessary to Daguerreotypists, a simple process for ascertaining whether it is so or not will be useful. To do so, take a glass-full, and add a few drops solution of soap in alcohol; if the water be pure, it will continue limpid—if impure, white flakes will be formed on the surface.

TO TAKE DAGUERREOTYPES ON IVORY.

Immerse ivory in a weak solution of nitrate of silver, and let it remain until the solution has given it a deep yellow color; then put it into a glass of clean water, and expose it in the rays of the sun until it becomes black; polish it, and a brilliant silver surface is the result. Coat it in the usual manner, submit it to the light in the camera, and finish and gild as you would the ordinary plate.

CHAP. XV.

RESEARCHES ON THE THEORY OF THE PRINCIPAL PHENOMENA OF PHOTOGRAPHY IN THE DAGUERREOTYPE PROCESS.

BY A. CLAUDET.*

The principal phenomena in the Daguerreotype process which have not yet been satisfactorily explained, are those referring to the following points:

1st. What is the action of light on the sensitive coating?

2d. How does the mercurial vapor produce the Daguerreotype image?

3d. Which are the particular rays of light that impart to the chemical surface the affinity for mercury?

4th. What is the cause of the difference in achromatic

* M. Claudet is not only one of the most theoretical but *practical* Daguerreotypists of Europe, and no man in the Old World deserves more credit for his persevering energy in experimenting and improving his art. He does not confine himself to the mere *role* of making money; his whole soul seems wrapped up in the study of his art, and instead of making it a mechanical business, he raises it to its proper sphere among the arts and sciences. I wish I could point to more than one artist in this country to emulate him. Our operatives should not be content with the superiority of their pictures over those of Europeans, but they should know the cause, and knowing should be able to explain it. They should study their art, and the sciences connected with it, much more than at present. *Nous verrons.*

lenses, between the visual and photogenic foci? Why do they constantly vary?

5th. What are the means of measuring the photogenic rays, and of finding the focus at which they produce the image?

These are the various subjects I shall have to treat in the present paper. At the last meeting of the British Association, which took place at Swansea, I announced that the decomposition of the chemical surface of the Daguerreotype plate by the action of certain rays of light produced on that surface a white precipitate, insoluble in the hyposulphite of soda, which, when examined by the microscope, had the appearance of crystals reflecting light, and which, when seen by the naked eye, were the cause of a positive Daguerreotype image. This fact had not been observed before. The opinion of Daguerre himself, and other writers, was, that the action of lights on the iodide of silver, had only the effect of darkening the surface and producing a negative image; but it escaped them, that under the darkened iodide of silver another action had taken place, and that the hyposulphite of soda could disclose a positive image. I have proved this unexpected fact in obtaining by the action of light only, and without mercury, images having the same appearance as those developed under the action of mercurial vapor. This direct and immediate effect of light is certainly remarkable; but the Daguerreotypist's process is not founded on that principle on account of the slowness of its action. It is fortunate that long before light can produce the white coating I have alluded to, it produces another effect, which is, the wonderful property of attracting the vapor of mercury. This vapor is condensed in white powder, leaving also, when examined by the microscope,

the appearance of reflecting crystals. The cause of the Daguerreotype image is due to that property, which was entirely discovered by Daguerre.

Mr. Moser has given an ingenious theory of the action of mercury. * * * * * * * * * * It is more probable that light exercises two actions on the iodide of silver, whether it is or is not combined with chloride of bromium. By one the iodide is decomposed, and the silver set free is precipitated on the surface in a white powder or small crystals by the other, which begins long before the former; the parts affected by light have been endowed with an affinity for mercurial vapor.

By means of my photographometer, (see Chap. XIII.) to the principles of which I shall presently refer, I have been enabled to ascertain that the pure light of the sun produces, in about two or three seconds, the decomposition of the bromo-iodide of silver, which is manifest by the white coating; while the same intensity of light determines the affinity for mercurial vapor in the wonderful short space of about $\frac{1}{1000}$ part of a second, so that the affinity for mercury is produced by an intensity of light three thousand times less than that which effected the decomposition manifested by the white coating.

For this reason it is difficult to suppose that the two actions are the same. We must admit that they are different. Long before it can operate on the decomposition of the chemical surface, light imparts to the sensitive coating the affinity for mercurial vapor, and this appears to be the principle of the formation of the image in the Daguerreotype process.

* * * * I stated that the red, orange and yellow rays destroyed the action of white light, and that

the surface recovered its former sensitiveness after having been submitted to the action of those rays. I inferred from that curious fact, that light could not have decomposed the surface, for if it had decomposed the compound, it would be difficult to understand how the red, orange and yellow rays could combine again elements so volatile as iodide and bromine, after they had been separated from the silver.

The action of light which can be destroyed by the red, orange and yellow rays, does not determine the decomposition, which would require an intensity three thousand times greater. It is the kind of action produced with an intensity three thousand times less, giving the affinity for mercury, which is completely destroyed by the red, orange or yellow rays. It seems, therefore, that I was right in saying that there was no decomposition of the compound during the short action which is sufficient to give the affinity for mercury, or in ascribing the formation of the image only to that affinity, while light, or the chemical rays which accompany it, communicate to the surface the affinity for mercury, and the red, orange, or yellow rays withdraw it. I must remark here a singular anomaly, viz., that when the sensitive surface is prepared only with iodine without bromine, the red, orange, or yellow rays, instead of destroying the action of white light, continue the effects of decomposition, or of affinity for mercury.

This phenomenon was announced first by Mr. Edward Becquerel, and immediately after M. Gaudin found that not only these rays continue the action by which mercury is deposited, but that they develope, without mercury, an image having the same appearance as that produced by mercurial vapor. M. Gaudin not knowing the fact of the

white coating, which is the result of decomposition by the action of light, could not explain the cause of the image brought out under the influence of the yellow rays.

I have observed, that the iodide of silver without bromine is about one hundred times more sensitive than the bromo-iodide of silver, to the action of light, which produces the decomposition of the compound forming the white precipitate of silver, while it is one hundred times less sensitive for the effect which gives the affinity for mercury; another reason for supposing that the two actions are different. It may be, that in the case of the ioide of silver alone, the decomposition being more rapid, and the affinity for mercury slower than when bromine is added to the compound, the red, orange and yellow rays having to act only upon a commencement of decomposition, have the power, by their own photogenic influence, to continue the decomposition when begun. This is the explanation of the development of the image under red, orange, or yellow glasses, according to M. Gaudin's discovery; but in the case of bromo-iodide, the red, orange and yellow rays have to exert their action on the affinity for mercury, begun a long time before the decomposition of the compound, and they have the power of destroying that affinity.

Thus it would appear that all the rays of light have the property of decomposing the iodide of silver in a longer or shorter time, as they have that of producing the affinity for mercury, or the bromo-iodide of silver, with this difference, that on the former compound the separate actions of the several rays continue each other, and on the second compound these separate actions destroy each other. We can understand that in the first case all the rays can operate the same decomposition; and that in the second

the affinity for mercury, when given by one ray, is destroyed by another. This would explain the various phenomena of the formation of the two different deposits I have described, and also explain the anomaly of the continuation of the action of light by the red, orange and yellow rays, according to M. Ed. Becquerel's discoveries on the iodide of silver, and of the destruction of that action by the same rays, according to my own observation, on the bromo-iodide of silver.

The red, orange and yellow rays, when acting upon an unaffected surface, are considerably less capable than the most refrangible rays, of imparting the affinity for mercurial vapor on both the iodide and bromo-iodide of silver; and they destroy that affinity when it has been produced on the bromo-iodide by the photogenic rays. It follows from that fact, that when the red, orange and yellow are more abundant in the light than the other rays, the photogenic effect is retarded in proportion to the excess of their antagonistic rays. This happens when there exists in the atmosphere some vapors which absorb the most refrangible rays. In these circumstances the light appears rather yellow, but is very difficult to judge by the eye, from the exact color of the light, and the proportion of photogenic rays existing in the atmosphere at any given moment.

The vapors of the atmosphere which make the light appear yellow, act as any other medium interrupting the blue rays and those which are the most refrangible. I prove by very simple experiment, the comparative photogenic action of rays which have passed through such media, and of those which have met with no similar obstacles; and also that that media which intercept the photogenic rays, will allow the illuminating rays to pass freely If I cover an engraving one-half with light yellow

glass, and place it before my camera obscura to represent the whole upon a Daguerreotype plate, I find that during the time which has been necessary to obtain the image of the half not covered, not the slightest effect has been produced on the half covered with the yellow glass. Now, if I cover one-half with deep blue glass, and the other with the same light yellow glass, the engraving will be distinctly seen through the yellow glass, and not at all through the blue. In representing the whole, as before, on the Daguerreotype plate, the half which was clearly seen by the eye has produced no effect, and the other which could not be seen, is as fully represented, and in nearly as short a time as when no blue glass had been interposed. * * * * * * * *
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In considering how difficult it is to judge by the eye alone of the photogenic state of the light, we can understand how the photographer is constantly deceived in the effect he tries to produce, having no means to ascertain beforehand, with any degree of certainty, the intensity of the light. * * *

The photographometer gives the means of comparing the degree of sensitiveness of two photogenic surfaces differently prepared and of different kinds. This is done by employing two moveable plates with seven vertical openings, and two plates with seven corresponding holes. Receiving both the same light during the same time, the number of spots on each surface will indicate the comparative sensitiveness of the two.

It is a remarkable fact, that the photogenic light cannot be measured except by geometrical progression; the difference of the effect in an arithmetical progression being imperceptible. In comparing the intensity of any two

spots following each other, although one has received double the light of the next, it is difficult to find any sensible difference in the color given by the deposit of mercury; it is for this reason that I have adopted the geometrical progression.

The photographometer has, therefore, taught me that when a Daguerreotype picture is too black, I must double the time of exposure for the next, in order to obtain a marked difference; and that when it is too white, or too much done, I must, for the next, considerably reduce the time of exposure.

This enables the photographer to try several experiments in order to improve the sensitiveness of his preparation, and to adopt the best. There cannot be a surer and simpler method of comparing two different degrees of sensitiveness. By this means I have found *that the sensitiveness of the prepared plate increases by being kept sometime before using it. A plate prepared one or two days beforehand, is twice as sensible as one prepared immediately.* When the prepared plates are kept in well-shut dark boxes, they may be prepared several days; I have employed some three or four weeks after they had been prepared, and I have found them exceedingly sensitive, and producing good pictures.

Since the publication of my photographometer, I have made an improvement which renders it more complete. Instead of one series of seven round holes, I have introduced four series; and by means of sliding blades, I can open and shut at will any one of these four series. This enables me to continue by repeated falls the geometrical progression from 1 to 512 on one plate, and when a second plate is added, from 1 to 8,192; so that I can compare and follow the different effects of light in a con-

siderable range of intensities. This is done in the following manner: After giving one fall with all the slides open, I shut one and give another fall, then shut the second and give two falls, and so on, always doubling the number of falls for every new slide shut. It is by this means that I have been able to discover at what degree of intensity of light the effect called solarization is produced. On a well-prepared plate of bromo-iodide it does not begin under an intensity of 512 times greater than that which determines the first effect of mercury. I also learn at what degree the decomposition producing the white precipitate without mercury manifests itself, both on iodide and bromo-iodide of silver. On the first it is 100 times quicker than on bromo-iodide, and on the last it is produced by an intensity 300 times greater than that which developes the first affinity for mercury.

In the course of my experiments I have noticed a curious fact, which became very puzzling to me until I was able to assign a cause for it. I shall mention it here, because it may lead to some further discoveries. I had observed, that sometimes the spaces under the round holes which had not been affected by light during the operation of the photographometer, in a sufficient degree to determine the deposit of mercury, were, as it was to be expected, quite black; while the spaces surrounding them were, in an unaccountable manner, slightly affected by mercury. At first I could not explain the phenomenon, except in supposing that the whole plate had previously been by accident slightly affected by light, and that the exposure through the hole to another sort of light, had destroyed the effect. I was naturally led to that explanation, having observed before, that one kind of light destroys the effect of another, as for example, *that the*

effect of light from the north is destroyed by the light from the south, when certain vapors existing in the east part of the atmosphere impart a yellow tint to the light of the sun.

But after repeated experiments, taking great care to protect the plate from the least exposure to light, and recollecting some experiments of Moser, I have found that the affinity for mercury had been imparted to the surface of the Daguerreotype plate by the contact of the plate having the round holes, while the spaces under the holes had received no similar action. But it must be observed, that this phenomenon does not take place every time. Some days it is very frequent, and at some others it does not manifest itself at all.

In considering that the plate furnished with round holes is of copper, and that the Daguerreotype plate is of silver, plated on copper, it is probable that the deposit of mercury is due to an electric or galvanic action, determined by the contact of the two metals; and perhaps, the circumstance that the action does not take place every time would lead to suppose that it is developed by some peculiar electric state of the ambient atmosphere, and to a degree of dampness in the air, which would increase the electric current. May we not hope that by understanding the condition in which the action is produced, and by availing ourselves of that property, it would be possible to increase on the Daguerreotype plate the action of light? for it is not improbable that the affinity of mercury imparted to the plate, is also due to some electrical influence of light. How could we explain otherwise that affinity for mercury given by some rays, and withdrawn by some others, long before light has acted as a chemical agent?

From the commencement of photography it was well

known that the rays operating being the most refrangible, had a shorter focus than those producing white light; for this reason: Daguerre himself recommended the use of achromatic lenses, in which all the rays were supposed to coincide nearly at the same focus; all the cameræ obscuræ are furnished with achromatic lenses, and constructed so that the plate could be placed exactly at the same distance as the ground glass upon which the image had appeared the best defined. But with these cameræ obscuræ, it was very difficult to obtain a photographic image so perfect as that seen on the ground glass, and it was only now and then, and as if by accident, that good pictures could be produced.

I soon observed this anomaly, and imagined it was due to some error in the respective position of the two frames, one holding the ground glass, and the other containing the plate, which by warping, or some other causes, might have been shifted at different distances from the object glass. Not being able to assign any other reason for the error, I constructed a camera obscura in which the ground glass and the plate were exactly placed in the same frame. In doing so, I was in hopes to avoid the least error or deviation; but to my surprise, the more correct I was in my adjustment, the less I could obtain a well defined Daguerreotype picture. This proved to me that I had to seek for another cause of the difficulty, and before going any further I decided to try if the visual focus was, or not, really coinciding with the photogenic focus. For the experiment, I placed at a distance from the camera obscura several screens on different plans. These screens being covered with black lines, I could see them very distinctly on the ground glass. I tried the focus upon one of the screens. To my surprise and delight, I invariably found

that the one that appeared well defined on the ground glass, was confused on the Daguerreotype plate, and *vice versa.* This was sufficient to prove to me the cause of the difficulty I had been laboring under, viz., that the visual focus was not coinciding with the photogenic focus. But the most surprising feature of that discovery was, that the photogenic focus was larger than the visual focus; at first consideration it should have been shorter, as the rays operating in photography are the most refrangible, although I could not at first understand the cause of that anomaly; it was sufficient to me to know, that in order to have a well defined Daguerreotype picture, I had only to set the focus on the ground glass for an object nearer the camera, at the distance indicated by the various screens. In continuing my experiment, I found some lenses in which the photogenic focus was shorter, and some others in which the two foci were coinciding.

M. Lerebour, of Paris, was the first, who, on my suggestion, examined the subject. He stated that by altering the proportions between the angles inscribed in the curves either of the crown or flint glass, he could render at will the photogenic focus longer or shorter than the visual focus; and by the same means could bring them to the same point. There is no question that M. Lerebour was right, as far as the result referred to the chromatic correction; but if, according to the density of the two glasses, certain curvatures are required to correct the spheraical aberration, these curvatures cannot be altered with impunity, only for the purpose of changing the direction of the most refrangible rays. For this reason, I have always preferred lenses in which the spherical aberration is the most perfectly corrected, without caring if the photogenic rays are or not coinciding with the visual rays, having the

means of ascertaining how I could obtain on my Daguerreotype plate the best defined image. In fact, from my own observations, that the red, orange, and yellow rays are antagonistic to the photogenic rays, that the last rays have a greater power when the former are proportionately less abundant, I am of opinion, that when the photogenic rays are only condensed on the plate, and that the others are disposed on the spaces more or less distant from the photogenic point, the action is more rapid; rapidity being the object in photography. I prefer lenses in which the two foci are separated, although the operation is a little more difficult, and requires considerable care.

The question of the photogenic focus is involved in another kind of mystery, which requires some attention. I have found that with the same lens there exists a constant variation in the distance between the two foci; they are never in the same relation to each other; they are sometimes more or less separated; in some lights they are very distant, and in some others they are very near, and even coincide. For this reason I constantly try their position before I operate. I have not yet been able to discover the cause of that singular phenomenon; but I can state positively that it exists. At first I thought that variations in the density of the atmosphere might produce the alteration in the distance between the two foci, or that, when the yellow rays were more or less abundant, the usual rays were refracted on different points of the axis of the foci, according to the mean refrangibility of the rays composing white light at the moment. But a new experiment proved to me that these could not be the real causes of the variation. I generally employ two object glasses, one of shorter focus for smaller pictures, and the other of larger for larger images. In both, the photogenic focus is larger

than the visual focus; but when they are much separated in one, they are less in the other. Sometimes when they coincide in one, they are very far apart in the other, and sometimes they both coincide. This I have tried every day for the last twelve months, and have always found the same variations. This density of the atmosphere, or the color of light, seems to have nothing to do with the phenomenon, otherwise the same cause would produce the same effect in both lenses. I must observe, that my daily experiments on my two object glasses, were made at the same moment, and at the same distance for each, otherwise any alteration in the focal distance would disperse more or less the photogenic rays, which is the case as I have ascertained it. The lengthening or shortening the focus according to the distance of the object to be represented has for effect to modify the achromatism of the lenses.

An optician, according to M. Lerebour's calculations, can, at will, in the combination of the two glasses composing an achromatic lens, adapt such curvatures or angles in both, by which the visual focus will coincide with the photogenic focus; but he can obtain this result only from one length of focus. The moment the distance is altered the two foci separate; because the visual and photogenic rays must be refracted at different angles in coming out of the lens, in order to meet at the focus given for one distance of the object. If the distance is altered, the focus becomes longer or shorter; and as the angle at which different rays are refracted remains nearly the same, they cannot meet at the new focus, and they form two images if the visual and photogenic rays were refracted parallel to each other in coming out of the lens, they would coincide for every focus; but this is not the case; it seems therefore impossible that lenses may be constructed in which

the two foci will agree for all the various distances until we have discovered two kinds of glasses in which the densities will be in the same ratio as their dispersive power.

There is no question so important in photography as that which refers to finding the true photogenic focus of every lens for various distances. I have described the plan I have adopted for that purpose. By means of that very simple instrument, every photographer can always obtain well defined pictures with any object glasses. But there is another method of ascertaining the difference between the two foci, which has been lately contrived by Mr. G. Knight, of Foster-lane, London. As that gentleman has been kind enough to communicate to me the very ingenious and simple apparatus by which he can find at once the exact difference existing between the visual and photogenic focus, and place the Daguerreotype plate at the point where the photogenic focus exists, I am very glad that he has intrusted me with the charge of bringing his invention before the British Association. For the scientific investigation of the question, Mr. Knight's apparatus will be most invaluable, as it will afford to the optician the means of studying the phenomenon with mathematical accuracy.

Mr. Knight's apparatus consists in a frame having two grooves, one vertical, in which he places the ground glass, and the other forming an angle with the first. The planes of the two grooves intersect each other in the middle. After having set the focus upon the ground glass, this last is removed, and the plate is placed on the inclined groove. Now, if a newspaper, or any other large sheet printed, is put before the camera, the image will be represented on the inclined plate, and, it is obvious, that in its

inclination, the various points of the plate will meet a different focus. The centre of the plate will coincide with the visual focus, and in the other direction it is longer. The frame is furnished with a scale of division having the zero in the centre; when the image is represented on the Daguerreotype, by applying against it another moveable scale of division, similar to the other, the operator can find what is the division above or under zero at which the image seems the best defined; and after having removed from the camera the experiment frame, and set the focus as usual upon the ground glass, he has only to move the tube of the object glass by means of the rack and pinion, and to push it in or out of a space corresponding with the division of the scale indicating the deviation of the true photogenic focus.* The tube of the object glass is for that purpose marked with the same scale of division.

Before concluding, I shall call the attention of all persons conversant with optics, to the singular fact I have observed respecting the constant variation of the foci. I have not been able yet to find its cause, and I leave its investigation to more competent persons.

I must remark that the principal difficulty of obtaining well defined pictures, is due to the dispersion of the chemical rays which are spread by glass prisms on a more or less elongated space; so that a spectrum formed by such glass prisms, may be shorter or longer according to the dispersive power of the glass composing the prism. It happens, therefore, that in some object glasses that dispersion may be less than in some others; and in such

* This fact has long been known to Daguerreotypists in the United States, and camera boxes are now constructed to obviate the difficulty.

lenses the variation of the two foci will be less observable. It appears, besides, that with the same glass, the dispersion is greater or smaller according to the quality of light or other atmospheric influences, and also according to the angle of incidence. Sometimes the various screens intended to try the focus, appear all well defined, although the screens are placed at different distances from the camera, in a range of twelve or fifteen inches. In this case, it is not so important to find the very best focus; and the image may be well defined whether the object is placed at twelve or fifteen inches nearer or further from the camera. But in some other circumstances, in setting the focus on one screen, the next, which is three inches distant, is confused, and the following still more; in those cases, the dispersion is at its maximum; and it is then that it is of the greatest importance to attend to trying the focus before operating.

CHAP. XVI.

POSITION.

True grace is inherent in nature, and is the attribute of the soul overflowing with a God-like perception of the grand and beautiful in nature; it is as far beyond the reach of the mind, grovelling in the depths of ignorance, to the one as to the other; and it is for this reason that we find so many, who, although they may admire a fine picture, statue, or edifice, are at fault, when asked the wherefore.

We have only to look upon the red man of the forest, in his wild, free state, for a confirmation of this fact. Nature is his only study, and from that he looks up to nature's God; views Him through His works—knowing little, it is true, of His great omnipotence and tender mercies—and looks upon Him with a sublimity of awe that is evident in every step, every motion, every gesture, and every thought of his mind. It may be thought by some that I am romancing in this picture of the Indian character; but a long sojourn among the north-western tribes, a knowledge of their religious rites, and scenes often witnessed in the forest and the council chamber, convinces me that in the savage breast there lurks a true conception of the graceful and beautiful.

Still I would not have it supposed, for a moment, that any one is debarred from appreciating and acquiring grace; although it were not possible to bend the lordly

oak in unison with the graceful lily or violet, yet its unseemly and tortuous branches and rough exterior may be trained and trimmed by skillful hands to delight the refined taste, while it is deprived of none of its grandeur.

So it is with the human form. Education, that great moulder of the mind, exerts its powerful influences, changes the boor to the philosopher, the awkward hind to the stately gentleman, and

"Just as the twig is bent the tree inclines;"

but only just in proportion to the natural instinct of the mind, and the bent given to it, will it duly observe and appreciate.

The body may be said to be under the same natural law. We have only to visit any dancing-school, study the character and ability of the teacher and his pupils, to understand this fact fully. If he be one in whom grace abounds, you will see him gradually mould that awkward miss or boorish master into personifications of grace and elegance; but if he be a mere automaton, who, without one idea on the poetry of motion, has resolved to turn into dollars and cents what little knowledge of the art he has occasionally picked up, you will see that awkward miss and boorish master, still the awkward miss, still the boorish master; while the naturally graceful will, by their own natural instinct, in grace improve. Dancing academies, properly conducted, are the schools of grace. There is this difference, however, between a natural and a cultivated taste; the first leads while the latter follows.

Any one can be a Daguerreotypist, but every one cannot be successful. A picture may be mechanically well done, yet not be pleasing to the eye or the taste; and where an operator is proverbially deficient in producing

sucn as are, he must expect to see his next door neighbor, who excels him in taste, as well as being his equal in mechanical skill, receive the patronage he deserves.

To obviate this superiority, is in the power of almost every one, who is not too indolent to study. Allison on Taste, is a good book to begin with; but do not stop there; go to the studios of our best artists, study the positions of their finest productions, observe the manner in which they dispose of the drapery, the position of the figure, and the effect of light and shade. Next visit exhibitions of statuary of acknowledged merit, and study them carefully; drink in deeply the criticisms of those whose tastes are above reproach, and fix indelibly in your mind such comparisons as are considered just. By this means you will be enabled to form a better judgment in regard to the merits and demerits in the figure of your sitter, and place them in the most striking, graceful, and pleasing position.

It is as necessary to study the various conformations of the body, in order to place it in ease and elegance, as to learn the alphabet before you can write a word; and as every individual differs more or less in structure from another, the points of difference should be noted, and position given accordingly.

These are matters which must, of necessity, be left to the taste of the artist, and if he finds himself deficient, he must endeavor to follow the directions above given, or seek the advice and instruction of those who are capable of giving them. But I have said, in a general way, as much as time and space will permit, and will now endeavor to particularize, although I candidly admit that I give my own views entirely; and as they may differ from other and more competent tastes, they must be taken only for

what they are worth, and their deficiencies or errors avoided by the study of other authors.

Fig. 32.

A large skylight with a screen of blue tissue paper—or the glass may be tinged with blue—gives the best light for Daguerreotype purposes, as well as for oil painting. In the first place, because the light is more evenly diffused about the room, and enables the operator to place the sitter so as to form the best and most pleasing contrasts or light and shade. In the second place, the blue tissue paper has the property of separating the yellow or non-photographic rays of light from the photographic, and admitting the latter only into the room.

FIG. 33.

As I have said in my "Hints and Suggestions," Chap. IV., the sitter should be placed so as to hide any defects in the conformation of the body or limbs, and to bring out all the good points. I know of no fixed rule to be observed, but should judge from my own observation, that where a person is short, and inclined to corpulency, as great a distance from the object glass as possible, with a slight inclination to one side, would be an advantage; while to a tall, spare figure, a nearer approach to the spectrum, and a full front of the body, would produce good effect. If the arms and legs are long in proportion to the body, a slight contraction of the first, and the latter drawn up near the chair, but not to so great a degree as to be awkward, will improve the picture. The hands should rest perfectly easy on the lap, neither too low or too high; or

one may rest upon a table, and the other support the folds of drapery or hold a book. In any case it should be so placed as to observe the unities of figure—a short, thick hand should present the thumb in the foreground, the first, third, and second fingers being slightly bent under. A very long hand looks best with the back in view, and a really beautiful one, neither too long or short, should present a two-thirds view, allowing it to taper off gracefully from the second joint of the little finger to the tip of the first. To thrust the legs forward at an inclination of forty or forty-five degrees, is very inelegant; and to lean back in the chair with one arm hanging over it, and the thumb of the other stuck in the button-hole, is any thing but graceful. A slight bend to the body forward, and a little to one side, will always improve the position and render the picture pleasing. A shawl or cloak thrown easily and gracefully over the shoulders, and so disposed as to hide any deformity, and give strong contrast between light and shade, will prove very effective.

Never allow your sitter to sit "*bolt upright*," and look directly into the camera, for reasons already given; it is very bad taste, and it is equally so to place either of the arms "*a-kimbo*," or in a group, for one to put an arm over the chair-back and on the shoulder of the other. In a picture where two persons are to be represented, it would be much more elegant either to let one stand leaning gracefully on the chair of the other, at a table, or against a pillar; in either case they should be turned partially towards each other, as if in the act of conversing. Or they may be seated opposite at a table, the right arm of the one and the left arm of the other resting upon it, their bodies slightly bent, with an inclination to the right and left

as if in conversation. The shoulders should be suffered to fall off naturally, and not be crowded upon the neck.

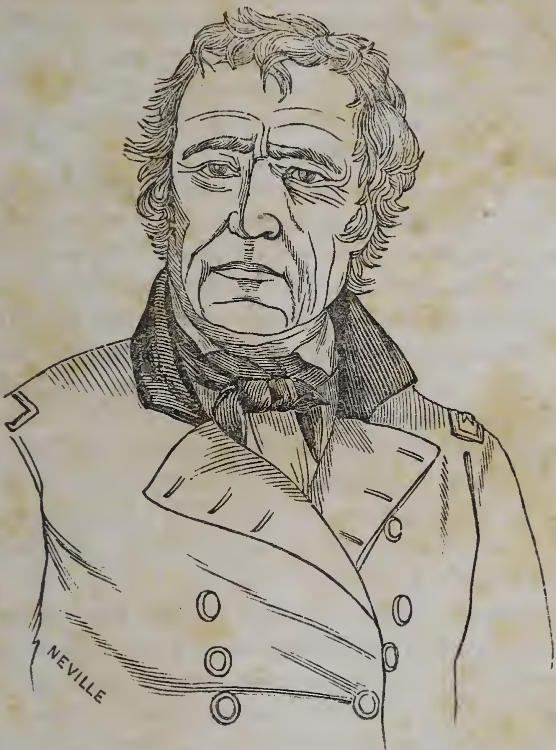
Where a group of more than two is taken, the judgment of the operator alone must be consulted, as their positions must depend upon the size and sex, and the nature of the light. I have seen beautiful effect produced (in a family group) by seating the husband in the chair, the wife on an ottoman at his feet, resting, with a slight inclination, upon his knee, and looking affectionately up into his face; while one child playfully climbed the back of his chair, and looked over his shoulder into his face, a second stood by his side playing with his watch seals and key, while to complete the picture, the eldest, a lovely girl of eight years, stood on the opposite side, just behind the mother, caressing the ringlets that gracefully hung from the parental head over the shoulder.

What positions could be more beautiful, graceful, or affectionate? At the same time it brought every figure in perfect focus, and the result was, a picture magnificent in the extreme.

An inspection of *Figures* 32 and 33, will give an idea of the difference between a graceful picture and one excessively awkward.

Fig. 34.

Fig. 35.



The position of the face should next be considered. There are many points to be observed in placing the head in a position to be the most effective. I have noticed that in a majority of instances, that the most homely faces make the handsomest pictures ; this is a fact that will be duly appreciated by all, and will undoubtedly lead to the query why it is so ? and I answer that it is mainly owing to the fact that ugly faces have more strongly marked outlines

than those that are beautiful; the image produced therefore by the camera possesses greater contrast in light and shade, which, while they give a greater depth of tone and a more pleasing effect, do not betray the defects. There are, of course, exceptions, but they are few, and might be remedied by proper position.

We will take for instance, *Figures* 34 and 35 as an illustration. They are both portraits of our worthy and gallant President in different positions. While the first represents him in a very unfavorable position, the other shows him as he really is, when animated and graceful.

In Daguerreotyping, I should, as a general thing, adopt the following rules, although in some instances I should possibly have to deviate.

A full round face, with large mouth, small eyes and nose, I should make what is called a half face, that is, where the whole of one side, and a *very small* portion of the other is seen, being but a slight remove from the profile likeness—*Fig*. 34.

Of a moderately full face, with aquiline nose and handsome mouth and eyes, I would make a three-quarter picture, wherein all the features of one portion of the face would be visible, and about one-fourth of the other.

A face in which the features were a little more prominent, a three-quarter view would be preferable.

And one in which the lines are very strongly marked, and bordering upon projecting angles, I should decidedly make a full front view.

Always endeavor to throw life into the expression of your sitter's face by animate conversation, or a pleasant and polished witticism, avoiding all approach to the broad grin.

I am not aware that any one else has made these obser-

vations, and there may be those who will differ from me; be that as it may, I give them for what they may be worth, and shall be happy—if my ideas are erroneous—to have them corrected by an older and abler hand. I have redeemed my promise to those who desired the insertion of this chapter to the best of my ability; not venturing to express *my own* opinions until several applications to those whom I consider as more competent had failed, to meet that encouragement I was led to expect. I might occupy two hundred pages of a work of this size on this subject, without exhausting it; but I trust what I have said will be sufficient for our present purpose.

20 Grains 1 Scruple ℈
3 Scruples 1 Dram ʒ
8 Drams 1 Ounce ℥
12 Ounces 1 Pound lb